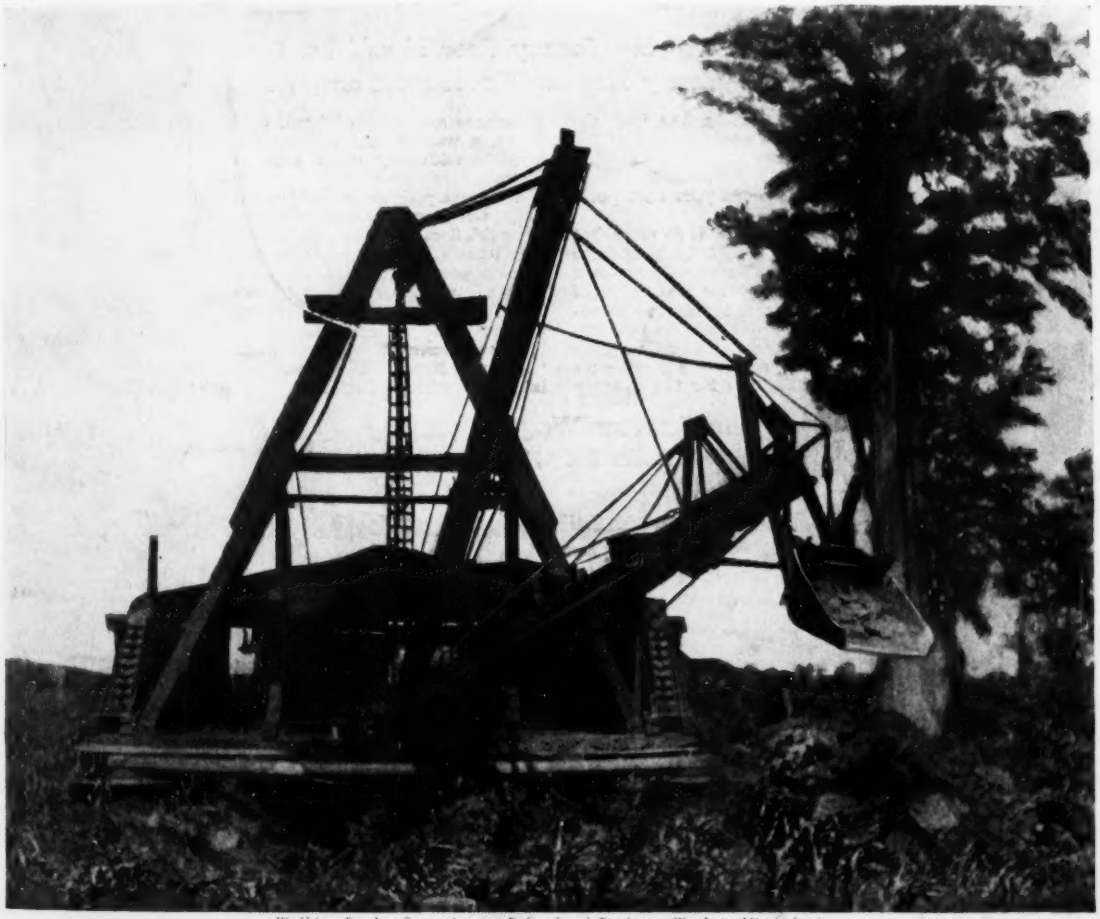
March 29, 1923

Engineering News-Record

Devoted to Civil Engineering and Contracting



Walking Dredge Operating on Delta Land Drainage Work in Mississippi

Pocket Strain Gage Records Stresses in Concrete Pavements
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Records of Walking Dredge Work in Delta Land Drainage
By A. S. Fry

Flat-Slab Designs for Two D. L. & W. Ry. Elevated Stations
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Spread Base Caissons in Foundation Work for Boston Bank

A Study of Office Building Live-Loads

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, *Editor*
Frank C. Wight, *Managing Editor*

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Educating the Highway Amateur

SEARCH for the universally supreme type of road is persistent. Last week at Harrisburg, Pa., at the conference of highway officials called by Governor Pinchot, evidence of the quest appeared repeatedly in the questions raised for answer. It is difficult for the heads of government not trained as engineers to avoid the notion that there is somewhere to be found a universally best road and that it will be disclosed if road officials will go into conference and talk enough about the subject. At the Harrisburg conference it proved easy as usual to raise a dispute between partisans of different types of roads and as usual this dispute arrived nowhere. The useful effort of the conference was the determination with which the engineer delegates drove home the truth that the selection of road type and its design are widely different problems in different sections of the country and that knowledge of traffic and its probable trend is essential to intelligent selection and design. There is no universally best road surface any more than there is a best type of bridge or a best size of shoes. If this fact can be established in the minds of public officials it will pay to hold many conferences like that called by the Governor of Pennsylvania even though they develop no thought with which the road expert is not familiar.

To Safeguard Municipal Bonds

IN 1922 the American people invested a billion and a quarter dollars in municipal and state bonds. This is a tremendous business and one closely related to that common bugbear of all of us, taxes. And yet it is a business controlled for the most part by inexpert men, the results of whose mismanagement are concealed in the maze of governmental accounting. The common assumption is that a city or a state cannot go bankrupt, that the issuance of obligations is so safeguarded by laws that there will always be ample security for all legal debt. The facts are that the rising cost of government and the multiplication of governmental units overlapping the same community assets have made repudiation a growing possibility. A few such possibilities, not specified by location, are indicated in a report just issued by the Institute of Public Service, of New York City. Gaylord C. Cummin, an engineer of long experience in municipal finance, has been looking into the books of some of our cities and counties and he finds some alarming facts. Many municipal issues are not legally valid, many can never be paid off under present practices, some bad faith has been revealed and mismanagement and confusion of accounts is general. Much of this abuse is unintentional; it is due to the ignorance of the office holder appointed or elected to a job which requires experience and financial knowledge. Only a little of it is due to corruption. But as long as the public will buy the condition will continue. It is proposed, therefore, to organize a so-called Municipal Bond Service, for the benefit of the buyer, a service which by publicity will try to educate both the buyer and the seller of governmental bonds to the dangers in unwise financing. So far the idea is embryonic, but the facts are authentic and the future is threatening. The proposal for reform is most commendable.

Why Not a Smaller Cement Sack

NO LITTLE part of the current high price of cement is due to the expense of the cloth sack. The material from which these sacks are made has been constantly rising in price until now each new sack costs the cement manufacturer approximately twice as much as he charges for it. Part of this is paid by the customer, a part is absorbed by the re-use of such bags as are returned and rebated for but a great deal is lost because of the loss of bags after one use and because of the cost of renovation. Obviously, a paper bag strong enough to stand transportation and thrown away after one use would mean a saving to both maker and user. Paper strong enough for the purpose is available but the main factor against its use is the apparent fact that the user demands his cement in quarter-barrel, that is 1 cu.ft., sizes and paper sacks of that size will not stand the necessary wear and tear. Fifty-pound, or approximately ½ cu.ft., paper sacks on the contrary seem to stand up under any normal service but the cement companies are reluctant to attempt them because of the impression among engineers and contractors that the present standard sack is so convenient as a unit of measure. Is this a fact? Is there inherently more difficulty in measuring with the more easily handled and cheaper ½ cu.ft. paper sack than with the standard 1 cu.ft. cloth sack? The cement manufacturers would like to know.

A First Step Which Should Count

SLOWLY but surely the idea is taking hold that transportation today is a unit problem, not to be separated into its hitherto antagonistic highway, waterway and railway elements. The unprejudiced student, not hampered by allegiance to any one of the three services, has long recognized the necessity for some better co-ordination, some superior means which would assign to each its economic field and would interlace the three to the greater good of each and of the people who pay the bills. History and practice and prejudice all have worked against any such co-ordination, but now the drive of economic events is forcing even the proponents of each to admit its necessity. Given a necessity and enough people who recognize that necessity, a consequent solution is only a matter of time. That is why the coming meeting of the Chamber of Commerce of the United States, at which the co-ordination of transportation is the major subject, is a hopeful sign. Such conferences as this can effect little direct action, but by bringing together the best minds in many complementary fields there can result a statement of

the problem which is the first requirement for its solution. The railways today are more willing than ever before to admit the place of the motor truck in the short haul and distribution field; the motor truck interests are just about ready to concede their inability to make money in the long hauls; the sane waterway advocates may doubtless be persuaded to throw overboard the lunatic fringe who see in the canal and river the cure of all our economic ills. When all of them sit around the same table some useful compromise should emerge.

Floor Load Data

OPPORTUNITY is given by the floor load measurements in the Equitable Building, reported in this issue, to bring together much-needed data on the floor loads which occur in different classes of building occupancies. There are few figures on record concerning such loads. Building laws prescribe loads for design, which loads vary picturesquely from city to city; and for the rest, a very rough sort of guessing is depended upon by designers. There is a fair justification for this process of guessing, since floors must be made strong enough to carry not only the particular loads of this or that tenant but any load that may chance to occur in the varied conditions of a long period, under changing occupancy. Occasional heavy concentrated loads are as likely to endanger a floor as excessive distributed loading. The necessary basis for all sound judgment of proper design loading is a large and comprehensive collection of data on actually existing floor loads. The Equitable Building weighings constitute an excellent beginning toward such a compilation. If engineers, architects, and industrial men in different fields will contribute each a little item of data from his own observation, a collection of load figures may be obtained that will have commanding importance in fixing a sound and economical basis for building design. These contributions will be of additional value if they include observations on load concentrations that may be expected in normal use, though the fundamental importance will lie in the figures on actual loads of regular occurrence, and on their grouping. How important the latter will be is plainly enough indicated in the sample sketches accompanying the Equitable data, which show very clearly that in most cases the larger part of the loading comes upon one or two of the floor members and that the required floor strength is quite different from that indicated by the average square foot figures. When such data are obtained from many different kinds of buildings—not merely office buildings—we will be a step nearer the ideal of efficiency and economy in building design.

Publicity for Public Works

FIFTY thousand dollars for a publicity campaign of engineering facts! That is what the Sanitary District of Chicago has appropriated to broadcast facts relating to its reason for being and its side of the water diversion controversy with the federal government. Just how much water does Chicago need to divert from Lake Michigan and the Great Lakes system to protect its water supply and maintain its remarkably low typhoid death rate? Perhaps a better way of putting the question would be to ask just how much should be allotted to Chicago. As the question now stands most people in Chicago, if they know anything at all about the controversy, see mainly the health side of it with water power decidedly as a side issue, while most people outside of Chicago, if they know or care anything about the case, see principally the fact that Chicago persists in making an illegal and disproportionately large diversion of water from the Great Lakes. The average individual soon is lost in the maze of lowered lake levels, early gentlemen's agreements in Congress, Illinois Valley protests, huge costs for sewage treatment, dilution factors, states rights, prehistoric outlets and actual present-day diversions, an intricate conglomeration of law and engineering, romance and sanitary science. Surely $50,000 is small enough for an advertising appropriation for this $75,000,000 going concern whose main business is to maintain the health of 3,000,000 people.

The 1922 Typhoid Honor Roll

SANITARY engineers, public health officers, and all others who have contributed in any way to the rapid decline of typhoid fever in the United States during recent years are to be congratulated on the remarkable showing for the year 1922 just made available through the prompt annual survey of typhoid fever in cities of 100,000 and over now made for the eleventh time by the *Journal* of the American Medical Association. Eighteen cities, as compared with the previous high record of ten, are on the 1922 typhoid honor roll, as having a typhoid death rate of two or less per 100,000. Three of these eighteen cities reported no deaths whatever from typhoid and seven cities had a typhoid death rate of from 1 to 0. All but five of the entire sixty-nine cities had typhoid death rates of less than ten. The highest in the list were Trenton with 15.9 and Nashville with 16.2, both well under the 20 per 100,000, which for many years was considered a creditably low rate.

The mass figures for the fifty-seven cities for which figures going back to 1910 are available show a decline in the typhoid death rate from 19.52 to 3.15 per 100,000, while the total deaths dropped from 4,114 to 851, although from 1910 to 1922 the total population under consideration increased from 21 to 27 millions. This is an actual saving of 3,263 persons from death by typhoid in 1922 as compared with 1910. A far larger saving would be shown by computing the typhoid deaths year by year at the 1910 rate.

The 1922 record for the sixty-nine cities is most gratifying, full of uncertainties as to the causes of some of the highly divergent rates as it certainly is. For instance, although the *Journal* comments on the probable causes of the typhoid rank held by some of the cities, it does not attempt anything of the sort for Trenton, which, it is only fair to that city to state, had a 1921 rate and also an average for the five years 1916-20 far below the figure for 1922. Trenton uses filtered Delaware River water and there is no apparent reason why, so far as the public water supply is concerned, its typhoid rate should not be as low as Paterson's, which also has a filtered water (from the Passaic), but Paterson had a typhoid death rate in 1922 of only 2.1 as compared with Trenton's 15.9. Jersey City and Newark in the same state, both with unfiltered supplies from upland sources, had a 1922 death rate of 1.6 and 2.7 respectively. Why Trenton makes so poor a showing is a proper subject for investigation.

More College-Bred Engineers for the Railways

ENGINEERING personnel problems on the railways have become sufficiently acute for the higher officials to take cognizance of them. Studies have disclosed that college men are not going into the service of the railways; in fact, investigators find that only about 5 per cent of the engineering graduates seek railway employment. This is far different from the old days of extensive construction when civil engineering and railway engineering were practically synonymous, and the young engineer drifted naturally into railway work.

Those who have the interests of the railways at heart recognize that the problems of the railway today cannot be met satisfactorily by the man whose greatest asset is his energy and physical strength, his ability to drive things through to a physical conclusion. Officials with a wider appreciation of the economic aspects are now needed, and they can be secured best from among men of technical training, rather than from those who come up through the ranks as foremen, roadmasters and telegraph operators. The problem now is one of operation, of improvement and increased facilities and of efficient maintenance of equipment and roadbed. It is a transportation question which involves economics, and deals more intimately with the complications of a highly specialized civilization than with the lines and grades, mules and mess camp of a construction job. Engineers, but of a different type, are needed just as much as in the old construction days.

Unquestionably it was the appreciation of the shortage and need of college men in railway work which led to the appointment by the American Railway Engineering Association of its recently announced committee on education. So far, apparently, the A. R. E. A. committee has concerned itself mostly in suggesting to the colleges methods whereby they may improve the teaching of transportation. But the difficulty now is not so much in presenting better collegiate material to the railways nor even in persuading the railways that they need the college trained engineer. What must be done is to persuade the young engineer that he has a future in the railway.

While one of the objects of the committee will be to let the colleges know the kind of teaching needed, the education on the part of the Association must extend to the railways themselves. It will be their great obligation to take care of the student when he is ready to enter the railway's employ. Probably this point of overcoming the reluctance of the roads to encourage and develop its technical recruit, once he is in the service, is the greatest service the committee can render.

Assurance that railway technical employees have equal opportunity with those outside will go a long way toward recruiting more of them. Officials must recognize that if these men are to be loyal to them, they themselves must be loyal to the trained employee, whose attainments must be recognized by reasonably adequate compensation and by advancement. Some of the traditions that stand in the way of promotion can undoubtedly be done away with sufficiently to enable the individuals in the engineering staff to progress toward the top in at least as favorable a manner as the untutored maintenance-of-way man or telegraph operator. The railways have a reputation of being a poor place to work, a place where many of the desirable, modern factors are lacking. Few engineers at present would recommend that their own sons seek railway employment.

When the committee's work has been assimilated by the officials on the roads, the collegiate problem of producing men to fill these positions of promise will probably be found to have solved itself.

Land Dredges for Southern Drainage Work

IT seems a fair conclusion from the records given in the article on drainage ditching in Mississippi that walking-dredge service in southern overflow and marsh lands is a question of weather and land conditions. Where these are favorable, or even where they are not notably bad, the land excavator has an economic place in drainage ditching which cannot be overlooked. Certainly it should not be put out of consideration because delta-land ditching practice in the past has not given it recognition.

Briefly the situation which confronts drainage engineers is this. Excavation by floating dipper dredges is so much less expensive that it is cheaper to dig a ditch large enough to give the dredge passage than to reduce the yardage by digging a smaller ditch requiring the use of other equipment. Engineers, therefore, have designed drainage ditch systems for construction by floating dredges. This has resulted in the upper reaches of ditch being larger than need be to satisfy the requirements of hydraulic design. In brief, unsymmetrical ditch systems have commonly been designed and built to meet the requirements of a construction method.

Again, with floating dredges, ditches have generally had to be excavated from outlet to source and, as a navigable channel is at all times a requisite of construction, it has also been necessary to joint up adjacent ditches by connecting channels not required except to shift the dredge from one unit of the system to another.

A method of avoiding these objections by using a combination outfit of floating dredges and land dredges of the "walking" type is suggested in the article referred to. This article makes out an excellent case for the walking dredge as a companion to the floating dredge in drainage ditching. Its case will be improved when full advantage of its possibilities is taken in designing ditch systems. For example, the common custom of paying for a minimum size of ditch based on floating dredge requirements instead of for the actual size, however small, of ditch dug is a case for remedy.

All things, however, are not favorable to the walking dredge. It has been developed mostly in northern drainage work and particularly in Minnesota and northern Wisconsin. In these fields the conditions are generally more favorable than in the delta lands of the south for a heavy land-traveling machine. The swamp land and muskeg of the north are fairly substantial ground in the dry summer season and in winter the soil, though soaked, is stiffened by frost. Some of the slough lands of the delta region are seldom dry for any considerable period and when wet are impassable for any heavy land-traveling machine. As indicated in the article, the chief causes of delay in walking-dredge work were slipping off wet banks into the ditch and miring in the "dry" bayous. Weather and land conditions are the factors controlling success.

Flat-Slab Designs for Two Railway Elevated Stations

Varying Conditions at Adjacent Sections of Lackawanna's East Orange Grade Elevation Viaduct Required Two Differing Types of Flat-Slab Details and Design

BY M. HIRSCHTHAL.
Concrete Engineer, Delaware, Lackawanna & Western R.R., Hoboken, N. J.

AS A PART of the third-tracking and grade elevation of Lackawanna R.R. through East Orange, N. J., it was necessary to build two elevated structures with the new stations at Brick Church and East Orange, consisting each of a long stretch of flat-slab reinforced-concrete viaduct with station facilities at both the street and track levels. As noted in *Engineering News-Record*, March 22, 1923, p. 536, the Brick Church viaduct has its outer row of columns set back from the face of the viaduct resulting in cantilevers, while the East Orange viaduct has fascia columns. Architecturally and structurally this results in two quite different types of structure, a comparison of which is the subject of this article.

Brick Church General Details—The Brick Church viaduct is an all-concrete structure 1,085 ft. long from end to end and may be considered as consisting of three parts, viz:—one at each end of sufficient width only for the acommodation of three tracks, and the one (by far the largest) in the vicinity of the station proper, providing platform facilities for the latter and therefore considerably wider than the ends mentioned above. The columns are arranged in 52 transverse bents 20 ft. apart c. to c. except at the west end and in four longitudinal rows, "A," "B," "C" and "D," except at the two ends where row "D" on the north side is omitted. (Fig. 1.)

Transversely the columns are spaced 21 ft. on centers with 7 ft. 2 in. and 7 ft. 5½ in. cantilevers, resulting in panels only slightly oblong. This transverse spacing prevails throughout the tangential section while for the curved portion at either side the three southerly rows are kept on a continuous line until the near-curb lines (bents 4 and 49) of Harrison and Halsted Sts. are reached; the constriction is confined to the northerly panel, the column line being kept parallel to the north face with an overhang similar to that at the tangent section. This arrangement obtained except at the stairways and at the elevator shaft of the island platform where of necessity the lines of columns were displaced.

Harrison St. at the west end of the viaduct is an important and much traveled thoroughfare, crossing the tracks at an angle of about 86 deg. with the tangent to the express track produced. A line of columns was placed at that angle along the center line of the street and two 20 ft. clear spans were provided on either side for driveways, making the column spacing 22 ft. 8 in. c. to c. measured at right angles to the column bents,

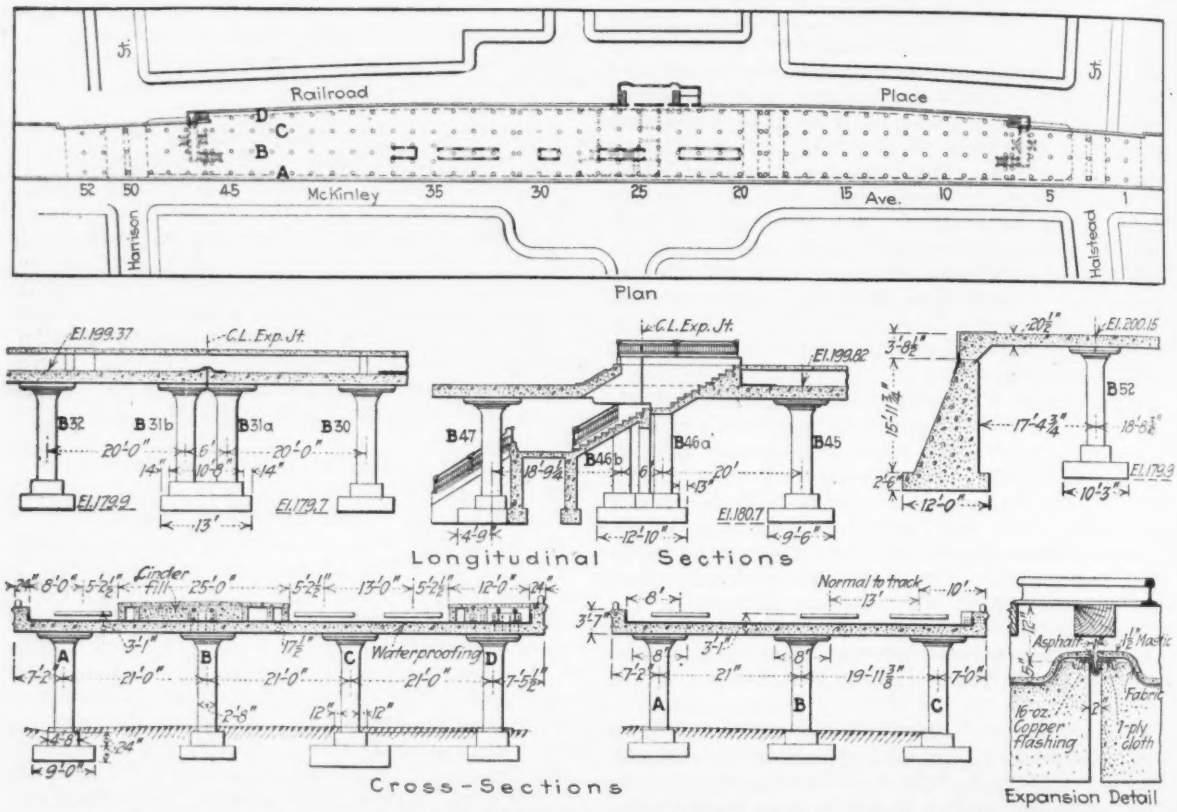


FIG. 1—DETAILS OF THE BRICK CHURCH VIADUCT AND STATION, DELAWARE, LACKAWANNA & WESTERN R.R.
Drawing shows plan of station, three typical longitudinal sections including expansion joint, and two typical cross-sections.

while the spans adjacent to the driveway on either side were made 18 ft. 9 in. centers. Bents 47 to 52 inclusive are parallel to the street line.

For the transverse spacing at this end the southerly row of columns was continued to the abutment while on the north side the line of columns was made parallel to the north fascia from the point where the third longitudinal row (C) of columns intersects the east curb column bent (49). The interior row of columns was located centrally between these two. To minimize the effect of expansion upon it, the exterior stairway from the north platform is made part of this section of the viaduct, the expansion joint being located at the head of these stairs because of the change in cross-section at the end of the platform.

At Halstead St. the requirements are not quite as severe and driveways of 16 ft. 4 in. clear between curbs were found to be satisfactory, so that it was not necessary to disturb the longitudinal column spacing, of 20 ft. centers, prevailing along the main part of the viaduct; the transverse column arrangement is similar to that at the Harrison St. end with reference to the fascias.

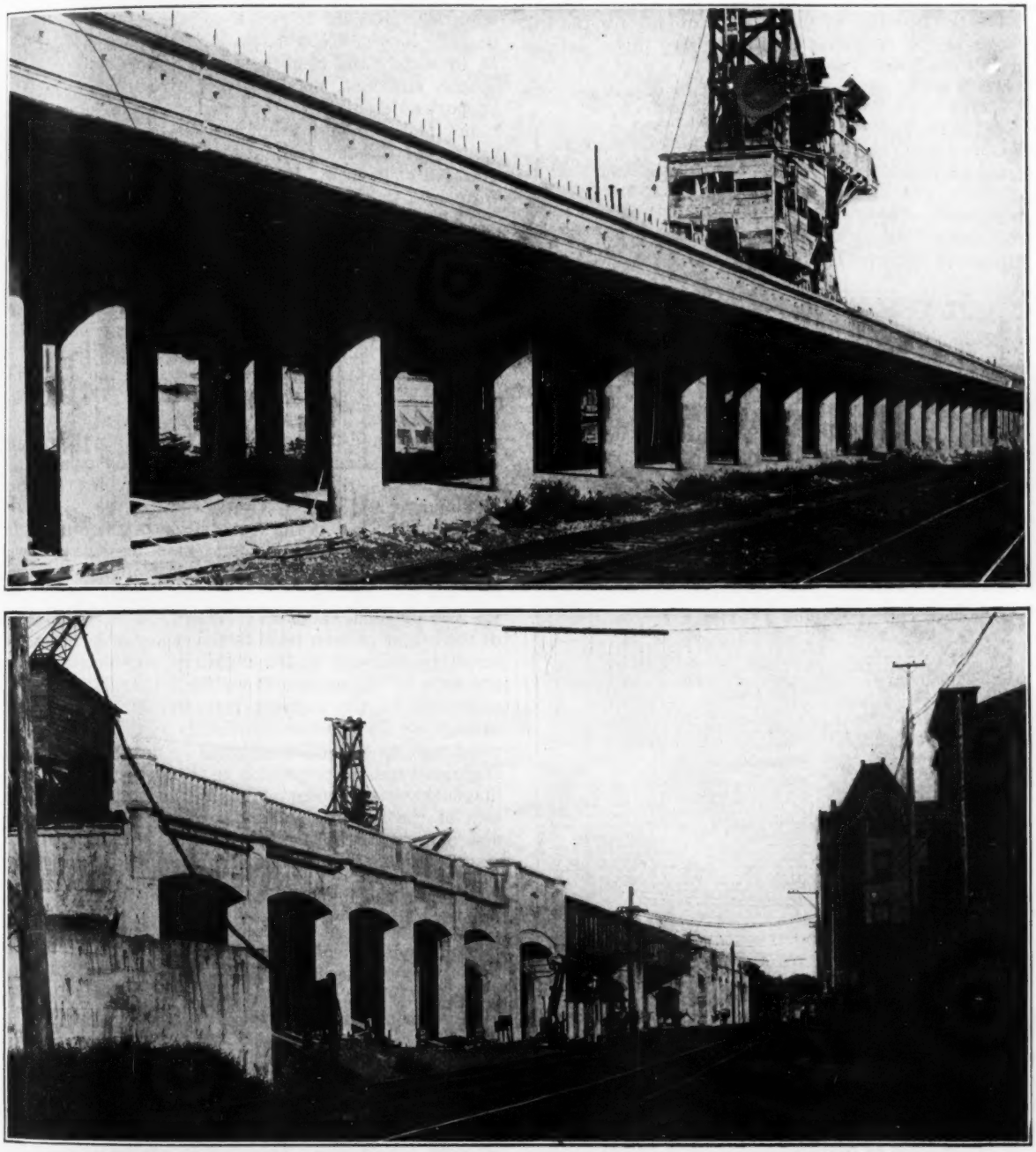


FIG. 2—SIDE VIEW OF TWO FLAT-SLAB VIADUCTS ON THE LACKAWANNA GRADE ELEVATION

Upper view shows Brick Church station and viaduct with columns set back from the parapet and cantilever slab; lower view is the Main Street crossing of the East Orange station and shows in the foreground the fascia column with the arches, which are merely showing arches, and in the mid-view the steel skew bridge crossing Main Street.

Here again the north stairway was made part of the end section of the viaduct for the same reason.

To obviate the necessity of driving to either end of the viaduct when desiring to reach some point on the other side a double driveway is provided on the line of Prospect Place, (bents 18 to 20), adjacent to the station.

The main portion of the viaduct running for the full length of the platforms is divided into three sections by two expansion joints consisting of a double row of columns 6 ft. on centers making two of the sections

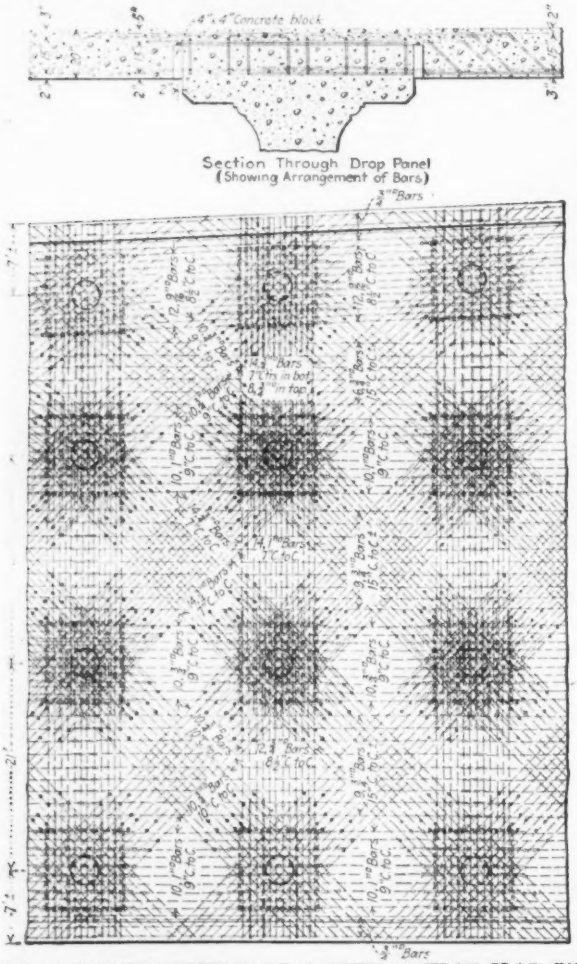


FIG. 3—REINFORCEMENT OF A TYPICAL FLAT SLAB OF THE BRICK CHURCH VIADUCT

about 250 ft. long and the third about 300 ft. in length. The longitudinal column spacing is 20 ft. centers throughout this main portion of the viaduct with 3 ft. overhangs at the expansion joints. The station is located midway between expansion joints, in order that its connection with the viaduct may be affected by temperature stresses as little as possible.

The columns are circular in cross-section and are designed as hooped reinforced columns, both the longitudinal bars and spiral reinforcement being considered as taking the vertical load as well as the concrete in the ratio of the moduli of elasticity of the two materials. The longitudinal bars extend and are bent into the slab. The columns are all supported on spread reinforced-concrete footings, the double row of columns at the expansion joints being carried on single footings for each pair of columns.

Loadings—The slab is designed to take locomotive loadings as well as those of the platforms and the canopy column concentrations, the following methods being pursued in figuring the moments due to the engine loading:

A system of spans from one expansion joint to the next is taken as a unit of a continuous structure. The train load consists of two E-65 engines followed by a uniform load of 6,500 lb. per lin. ft. and was so placed as to satisfy the conditions respectively of maximum column reactions, maximum negative moments at the support adjacent to the end and over the interior columns, and also of maximum positive moments at the centers of the end and interior spans. For the computation of moments in the transverse direction, a uniform load w was assumed so placed along the line of tracks (longitudinally) as to produce maximum moments corresponding to those found for the conditions of the locomotive concentrations, and the moment from this uniform load was equated to that derived for the concentrations from which resulted the equivalent uniform load. This gave the basis for the moments transversely; the live-load being spread over 13 ft. and each track located on the transverse column system the maximum moments for one track, two tracks or three tracks loaded was obtained and the maximum used. Moments were then found for the dead-load including the canopy column concentrations as well as for end column restraint and together with the impact combined to obtain maximum conditions.

The next step was the distribution of these moments over the various bands. The maximum positive live-load moment longitudinally, was considered spread over 13 ft. and resisted by the two half longitudinal bands and the two diagonal bands in inverse ratio of the distance of the center of each band to the center of loading; the resulting moment in the diagonals was increased by the ratio of the spans. Since the diagonals also resist a portion of the moment transversely, one half the average of the transverse moments at the edge of each panel was considered distributed to the transverse and diagonal bands in proportion to their spans. When the diagonals were of unequal length, the sum of their portion of the longitudinal and transverse moments was distributed between them inversely as the square of the diagonal spans. The dead-load moments were likewise distributed and impact added by formula $\frac{LL^2}{DL + LL}$.

The reduction of these moments for the design of column capitals and the shortening of span resulting therefrom, was based on the coefficients of the Chicago Building Code, viz: 0.8 for negative moments, 0.6 for positive moments of main bands and 0.4 for positive moment of diagonal bands.

The reinforcing steel was then selected for each band based on a thickness of slab 1 ft. 8 in. with 10 in. additional for the drop panels, the required number of bars being bent up over the supports and carried into the adjacent panels, while temperature steel was provided in the upper plane in the longitudinal direction as shown in the typical panel, Fig. 3.

Stairways—One of the interesting features of this viaduct is the design of the stairways, already referred to, at each end of the westbound platforms. Inasmuch as the whole structure has cantilever fascias, it was necessary to design a cantilever stairway and in order to provide sufficient vertical clearance under the soffit of the stairs to permit of use as a portion of the driveway, it became imperative to make a turn in the stairway,

parallel to the street line. This turn in the stairway produced complications of two kinds, which resulted, first, in sloping the main slab in order to provide sufficient headroom for pedestrians along the stairway, and second, in a two-way cantilever slab for the stair platform at the turn so as to provide the maximum headroom under the slab for the driveway. To make the sidewalk of the street accessible to the space under the main viaduct there was left an opening under the stair stringers sufficiently wide to form a passage. A flight of stairs in each direction from the platform connecting the island stairway with that from the north platform provides access both to the sidewalks of the street and the walk under the viaducts.

Station Details—The station construction both under the track slab and in front of the viaduct is of reinforced concrete up to the elevation of the track platforms

A novel feature of the design of this viaduct, also present at the East Orange structure, is the placing of drainage channels under the platforms at their edges and pitching the slabs slightly in that direction to take care of the water from the tracks, platforms, and also from the canopy roofs, by means of pipes emptying into the channel. Shallow openings, 4 ft. x 12 in. are provided immediately above the waterproofing and the protection coat, at ten-foot intervals, while clean-cut openings, 2 ft. x 2 ft. 8 in. so designed as to permit of flushing in case of necessity are left every forty feet.

The waterproofing which was carried clear across the slab and up the sides of the parapets consists of a two-ply membrane of asphalt-saturated "Karnak" cloth laid in "Karnak" asphalt protected with two ¾ in. thick layers of asphalt mastic for the slab, and brick for the parapets. The expansion joint is waterproofed in addition

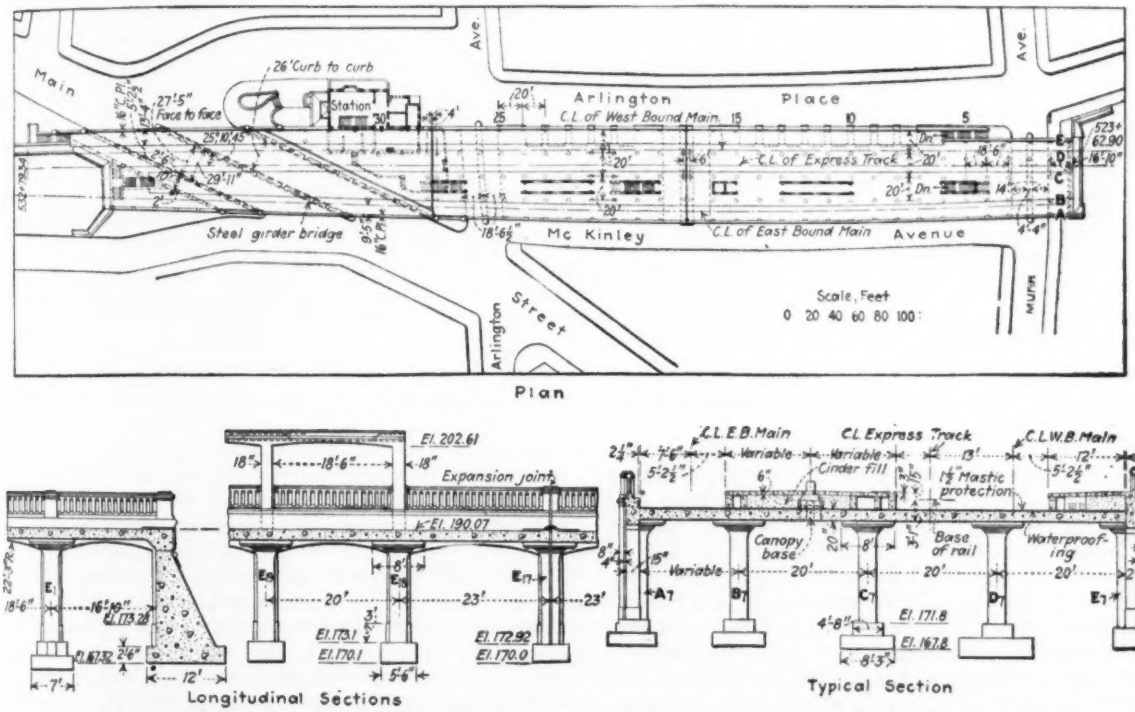


FIG. 4—EAST ORANGE STATION, DELAWARE, LACKAWANNA & WESTERN GRADE ELEVATION
Drawing shows plan of track level with under structure shown dotted, typical longitudinal sections and cross-section.

and is of brick above that line, the molding on the viaduct fascia being carried around the station building as the line of demarkation between the concrete and brickwork. Concrete walls under viaduct are brick-faced.

For architectural reasons as well as to facilitate driving in and out of the station there was provided a large opening at the street fascia of the station building requiring the construction of a long-span reinforced-concrete girder which supports reinforced-concrete beams, spanning from the main viaduct slab to this girder. Pockets were provided in the main slab so that these floor-beams would transfer their reactions directly to the viaduct columns along the lines of which they were placed. To prepare for subsequent erection of the canopy columns supported by these beams, openings as well as anchor bolts were provided, and these occurring near the supports of the beams required special provisions for shear in the form of haunches and stirrups closely spaced.

with sheet copper and asphaltic cement filled as per detail in Fig. 1 which is the type that has been used on all the viaducts.

The columns, fascias and the faces of the abutments are bush-hammered in order to enhance the appearance of the structure, as well as to remove surfaces otherwise used for literary purposes by the juveniles.

The construction work was carried along in transverse sections of three to four bays each from west to east without any serious delays. The H. F. Curtis Co., which had the contract for this section of the work, elected to use steel sectional forms for both the viaduct and the retaining walls.

Details of East Orange Structure—The viaduct in connection with the East Orange station is 842 ft. long and in contrast to that at Brick Church, comprises three different types of construction. The problem presented itself of harmoniously connecting them architecturally as well as structurally. It would not be amiss to state

the reason for the variation in type of construction.

Main St. is the most important thoroughfare in East Orange with a double-track trolley line, and heavy vehicular traffic requiring wide driveways 26 ft. clear between curbs. This, coupled with the facts that the center lines of tracks and street form an angle whose skew is 65 deg. and the tracks on a curve tend to accentuate the skew, results in fascia spans of 70 ft. for the inside (concave side) of the curve, and 75 ft. for the outside, precluding the use of reinforced concrete for this portion of the structure. The triangular section remaining west of this construction is moreover not adaptable for column and four-way slab construction which prevails east of Main St. so that the girder and slab type was substituted.

Due to the presence of the street car line operated by the overhead trolley system, a minimum overhead clearance of 14 ft. was required, and to obviate the necessity of increasing the grade of the railroad tracks at this point due to excessive slab depth a floor slab was designed of 30 in. girder beams varying in spacing from 2 ft. to 5 ft. filled solid with concrete, with 3 in. protection both top and bottom forming a solid floor 3 ft. thick, (Fig. 5). The fascia girders were not encased because of the increased load and because all portions are accessible to painting. An expansion joint was located near the center of the east sidewalk span, both the structural steel construction and reinforced-concrete work being cantilevered from the spans beyond.

The girder beams are supported by three lines of piers, 2 ft. 6 in. thick, with arched openings, the ends of the piers encasing the structural steel columns which support the fascia girders. These piers are carried on continuous reinforced-concrete spread footings for the full length, requiring an I-beam grillage only at the center column which carries the two 75-ft. span girders.

The triangular section west of the structural steel spans consists of a pier 2 ft. thick with arched openings symmetrical with those of the other side of the 10-ft. sidewalk, surmounted by a reinforced-concrete slab which is continued over the rest of the triangular section until the abutment is reached, being supported by the fascia columns and arched girders as well as a row of columns and girders on either side of the stairway. The thickness of the slab over the sidewalk span is 1 ft. 7 in. and the reinforcement is normal to the pier line while the slab over the remainder of the area is 2 ft. 7 in. thick, the reinforcement being varied for the varying spans normal to the line of the stairway.

Flat Slab Design—East of Main St. the structure is a cantilever flat slab supported on 34 bents of columns; bent 34, the end of the triangle, consists of a single column increasing to a 5-column bent on the east row of the expansion joint, bent 28. The longitudinal spacing of the bents for this section is 21 ft. 4 in. c. to c. to conform with station requirements, the station occupying practically the whole length. Bent 26 is located along the center line of Arlington Ave., which forms an angle of about 86 deg. with the center line of express track and the two adjacent bents, 27 and 25 with a spacing of 18 ft. 6½ in. centers parallel to the line of 26 provide 13 ft. 10 in. clear roadways. The remainder of the bents are placed at right angles with the center line of express track and 20 ft. apart c. to c. except the five in the vicinity of Munn Ave., at the east end of the viaduct, which are 18 ft. 6 in. centers.

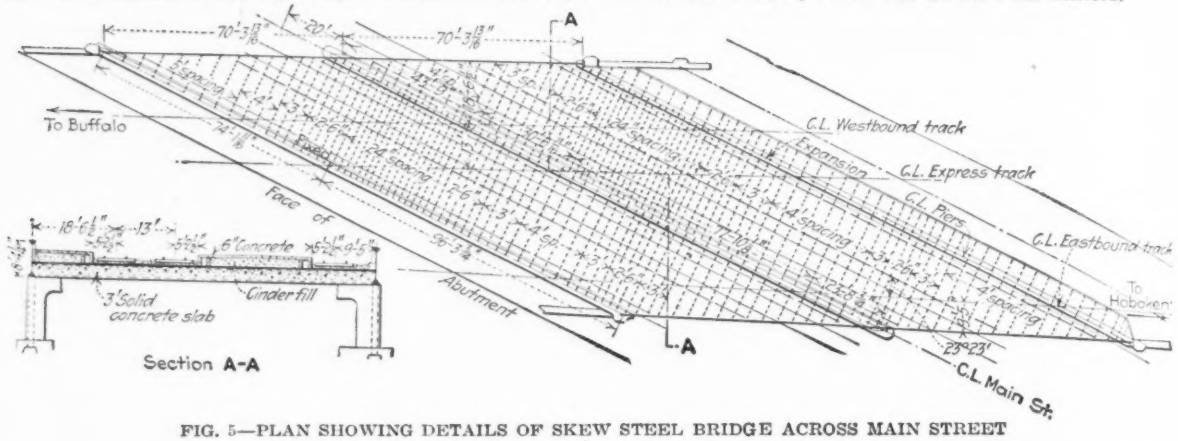


FIG. 5—PLAN SHOWING DETAILS OF SKEW STEEL BRIDGE ACROSS MAIN STREET

Due to the fact that this viaduct has fascia columns there are five longitudinal rows, marked, "A," "B," "C," "D" and "E," for facilities similar to those of Brick Church carried by four rows. Since the curvature along the track at this viaduct is taken by the eastbound track, it is the southerly panels that are made to vary while the "B," "C," "D" and "E" rows of columns are kept parallel and 20 ft. apart c. to c., resulting in square panels; the south face and column row "A" are carried parallel to the eastbound track and this end spacing varies from 17 ft. 5 in. to 11 ft. 3 in. The stairway at Munn Ave. beginning at bent 6 reduces the column spacing for the two northerly rows from 20 ft. to 15 ft. centers from this point to the abutment. Fig. 4 shows the general plan, the parts under the slab being shown dotted, and longitudinal cross-sections.

The triangular section was completely isolated by an expansion joint transversely at bent 28 and one parallel to the street line at the end of the cantilever. The only other expansion joint is at bent 17 which is also the center between two driveways providing access from one side to the other between streets. Like those of the Brick Church viaduct the columns are circular and hooped except the fascia columns which for architectural reasons are of a combined section. All the columns are supported on independent spread footings. The design of the slab is similar to that at Brick Church with the difference, however, that the ends were considered restrained by means of the fascia columns and arches and thus affected the moments transversely while the triangular section with its heavy cantilever and variation of number of bays presented a variety of

conditions of loading to be investigated. The resulting moments were treated similarly to those described in connection with the Brick Church viaduct and the reinforcement selected using similarly a 1 ft. 8 in. thickness of slab and 10 in. additional at the drop panels.

Expansion—The difficulty in connection with the design of the expansion joints east of Main St. was that of determining the direction of the expansion and its action on the structural steel section with its longitudinal girder parallel to the track and transverse floor beams normal to the street line, together with the action on the triangular reinforced-concrete section. It was determined to put one joint transversely at the end of the triangle as well as one along the hypotenuse which is the junction of the structural steel and concrete structures. The detail of the intersection of these two joints which now appears simple, with a puzzle until solved. The details of this intersection as well as other details of this joint are shown in Fig. 6. For architectural effect the fascia columns at all the expansion joints were made single instead of double columns and were split as shown also in Fig. 6. This same cause resulted in the treatment of the canopy columns and supports so that they were carried by one section and cantilevered over the other.

The station itself is of brick with gray terra cotta trimmings—Renaissance style. The entrance to the station on Arlington Place being several feet higher in elevation than that at Main St., the plaza was set at the elevation of the waiting room floor level, so that the stairway to the island platform could be reached without descending a flight of stairs. Stairs, however, provide access to Main St. and Arlington Ave. sidewalks.

The architectural treatment of the viaduct was a problem not only of producing a pleasing structure but also of keeping the various portions in harmony while treating them in accordance with the material of which they were constructed. The design of the portals over the sidewalk spans accomplishes this purpose, completely separating the two materials yet forming a connection between them. To increase the effectiveness of the treatment the structural steel girders were painted concrete color. All the columns are faced with pilasters projecting above the top of the railing and connected with flat segmental arches, below the slab. The balustrade between the pilasters is of open concrete construction. The canopy columns on this viaduct differ from those of Brick Church which are of structural steel, in being of concrete, and therefore subject to architectural treatment. Concrete arches are sprung between the canopy columns which were first poured to the springing line of the arches and which were provided with steel plates embedded and secured with anchor bolts firmly bonded into the columns. After the structural steel bracket was bolted to the plate above mentioned, and the I-beam purlins erected, the concrete canopy roof slab was poured together with the arches and the coping which was added to enhance the appearance.

To prepare for future electrification sufficient platform clearances were provided, for third-rail installation, as well as foundations for catenary supports, so either emergency would be met. The detail of the catenary support for the platform side was so designed as not to interfere with pedestrians.

The expansion joint through the stairs from the island platform was treated somewhat differently from that at Brick Church. The stairs were cut immediately below the main slab and the stairs and strings below this point were cantilevered from the columns at the stair landing.

Construction—The sequence of construction was governed by the necessity of having the Main St. crossing covered at the earliest possible moment; this portion of the construction was therefore first completed followed by the portion west of this, after which the flat slab work east of Main St. was poured, the columns of course being poured in advance of the slabs. The forms in this structure were of wood, except for the

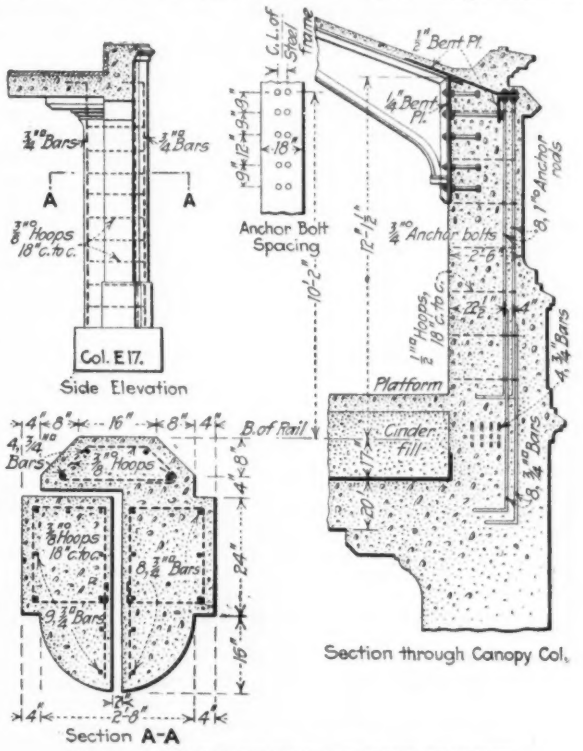


FIG. 6—DETAILS OF EAST ORANGE VIADUCT

circular columns, forms for which were of steel. Hyde, McFarlin & Burke handled this work. The waterproofing for this viaduct is similar to that at Brick Church with the exception that Hastings asphalt mastic blocks, 1¼ in. thick, were substituted for the mastic laid in place, resulting in quite a saving of time.

A comparison of the two types of viaducts is interesting. The advantages of the cantilever type (Brick Church) are economy of construction particularly where foundation work is expensive, the simplicity of the architectural treatment, greater rapidity of construction, and the availability of the space under the cantilevers for driveway, hence less property damages. The advantages of the column fascia type (East Orange) are the elimination of the cantilevers, amenability to special architectural treatment, greater freedom in the location and design of stairways, the availability of greater space under the viaduct for commercial use, and better connections with the station construction.

These viaducts were designed under the direction of the writer, with the Main St. crossing under A. E. Deal, bridge engineer, and the stations under F. J. Nies, architect. O. H. Kellogg is resident engineer and M. H. Doughty, division engineer. Both design and construction are in final charge of George J. Ray, chief engineer of the railroad.

Analysis of Principles Affecting Passenger Station Design

Abstract of a report submitted by the Committee on Yards and Terminals to the annual convention of the American Railway Engineering Association held in Chicago, March 15-17.

A COMPREHENSIVE analysis of the principles affecting the design of passenger stations deals specially with the proper relations between the amount of business handled and the size and arrangement of the various station facilities. Conclusions presented are given below and the accompanying table indicates the relations which should exist between business handled and facilities provided in passenger stations for main-line traffic.

1. The through and loop types of stations are superior to the stub type from the standpoint of train operation.

2. The number of station and approach tracks required to handle a given traffic depends on type of station, location of coach and locomotive facilities, size of station, length of station tracks, character of traffic, design of throat and method of operation.

3. For through passenger train operation a stub terminal station will accommodate on an average two trains per track per hour, and a through terminal station between two and three trains per track per hour.

4. A ratio of from 2.5 to 3 station tracks to one throat track should be adequate if the throat is properly designed.

5. All stations should have a sufficient number of long station tracks to accommodate the longest trains.

6. Station platforms at car-floor level are superior to those at the level of top of rail, as the hazard and inconvenience resulting from the use of car steps are eliminated and the handling of passengers is expedited. However, the high platforms interfere with inspection of equipment.

7. There are many advantages in the use of separate platforms for trucking and for passengers, as station operation is facilitated and passengers are saved annoyance.

8. The requirements of through passenger and suburban service are so dissimilar that it is desirable to make a complete separation of the two classes of service.

9. Ramps are desirable where their use does not increase the distance traveled to reach a given point, and where the gradients are not in excess of 10 per cent.

10. The principal station facilities, such as information booth, ticket office, baggage check counter, parcel check room, etc., should be located in proper sequence along the line of travel and should be clearly indicated.

11. A complete separation of inbound and outbound traffic, particularly in large stations, is desirable, so that there will be no conflict between lines of travel moving in opposite directions.

12. Constructing rentable office space in connection with passenger stations offers opportunities for assisting in carrying the interest charge resulting from the construction of stations.

13. If the station building is surmounted by an office building the entrances to the latter should be independent of the station. However, consideration should be given to the possible patronage of occupants of the office building.

14. A passenger concourse is very desirable and is used effectively in many stations as an exit passage way, which permits arriving passengers to reach the street without passing through the station.

15. The required width of passenger concourse depends upon the character and amount of traffic and number of entrances and exits from the concourse.

16. A train concourse is advantageous, as it permits of serving one station platform by several train gates or conversely the serving of several platforms from one train gate. In stub stations it permits trucking from one platform to another without entering the passenger concourse.

17. A width of 20 ft. for a train concourse is adequate if it is not used extensively for trucking.

18. The waiting rooms should be located at one side of the line of travel, but near to the passenger concourse and adequately equipped with bulletin boards, clocks and other information devices so that passengers will be content to remain in the waiting room.

19. The practice of installing pay toilets is increasing. They are favorably considered where installed and are the source of a substantial revenue.

20. Ticket offices should be located adjacent to the direct line of travel, but should be so arranged that passengers waiting to secure tickets will not interfere with the general flow of traffic.

21. The parcel check rooms should be easily accessible for both inbound and outbound passengers and should have every facility for handling parcels quickly. Where the amount of business justifies, separate counters should be provided for receiving and delivering parcels.

22. The extent of cab facilities depends on the size of the city, character of taxicab service and other means of local transportation. In cities where good taxicab service is provided at a reasonable rate an ever-increasing percentage of passengers is using that service as a means of reaching and leaving the station.

23. Concessions have proved profitable in most stations and are desirable not only for producing revenue but as a facility which adds to the comfort of the passenger.

24. The relation which should exist between business handled and the size of facilities is subject to variation due to local conditions, class of traffic, type of service rendered, outside competition, large variations in estimates of normal rush-hour business handled and the varying ideas of what constitutes adequate service.

25. The following table represents under average conditions the relations which should exist between business handled and the size of through passenger (not suburban) station facilities:

RELATIONS BETWEEN BUSINESS HANDLED AND FACILITIES PROVIDED AT PASSENGER STATIONS

Station Facility	Unit	Facility Required for Normal Number of Rush-Hour Passengers Indicated								
	Passengers	250	500	750	1000	1500	2000	3000	4000	5000
Area of main waiting room	100 sq.ft.	30	53	72	89	112	128	155	178	200
Seating capacity of main waiting room	No. of seats	143	213	270	315	400	465	570	665	750
Area of women's waiting room	100 sq.ft.	5	7	9	11	14	17	23	29	35
Area of men's waiting room	100 sq.ft.	5	6	7	8	9	11	14	16	
Total area for waiting purposes	100 sq.ft.	55	88	116	137	167	195	238	275	306
Total seats in waiting areas	No. of seats	190	300	390	470	590	700	880	1050	1200
Total area of lobby, concourse and all waiting rooms	100 sq.ft.	80	152	208	256	320	376	472	552	624
Area of men's toilet rooms	100 sq.ft.	4	6	8	10	13	15	20	26	31
Number of men's water closets	Number	6	9	12	15	19	23	29	35	41
Number of urinals	Number	5	8	10	12	15	17	20	23	25
Number of men's lavatories	Number	3	5	7	9	11	13	18	22	26
Area of women's toilet rooms	100 sq.ft.	3	4	5	6	8	10	13	16	18
Number of women's water closets	Number	7	9	12	14	17	19	23	27	30
Number of women's lavatories	Number	3	5	7	9	11	13	17	21	25
Area of ticket offices	100 sq.ft.	4	7	9	11	14	17	21	26	
Number of ticket windows	Number	3	5	7	8	11	13	16	18	21
Number of telephone booths	Number	3	4	5	7	10	13	19	25	31
Area of telegraph facilities	Sq.ft.	100	130	150	170	210	230	280	310	330
Total area of dining and lunch rooms	100 sq.ft.	9	14	19	24	34	43	63	83	102
Total number of seats in dining and lunch rooms	Number	34	53	72	93	129	173	249	327	407
Area of kitchen	100 sq.ft.	5	8	11	14	20	26	38	50	62
Area of news stand	Sq.ft.	115	185	240	290	380	450	565	695	820
Number of barber chairs	Number	2	3	3	4	4	5	6	7	8
		Number of Pieces of Baggage Handled Daily								
	Pieces	250	500	750	1000	1500	2000	3000	4000	5000
Area of baggage room	100 sq.ft.	20	33	45	60	87	112	166	219	272
Baggage room tailboard frontage	Lin.ft.	38	62	79	95	125	150	194	230	263
		Number of Parcels Handled Daily								
	Pieces	250	500	750	1000	1500	2000			
Area of parcel check room	100 sq.ft.	4	6	8	10	14	18			
		Number of Pieces of Hand-Baggage Handled Daily								
	Pieces	250	500	750	1000	1500	2000	3000		
Area of hand-baggage facilities	100 sq.ft.	4	6	7	8	10	12	16		

Pocket Strain Gage Gives Stresses in Concrete Roads

Instrument Slightly Larger Than a Fountain Pen Gives Well Co-ordinated Results in Field Tests

By A. T. Goldbeck
Chief Division of Tests, Bureau of Public Roads, Washington, D. C.

When the modulus of elasticity of the concrete is known the strain or deformation of the top or bottom surface of the slab is a direct indication of the stress produced. Hitherto it has been almost impossible to measure these deformations under moving loads because there have been no instruments suitable for the purpose.

A strain gage for the measurement of deformations in the top fibers of a concrete road surface must occupy very little space. It must be capable of being installed beneath the concrete surface so that the motor truck wheel may run directly over the position of installation. It must be very sensitive to extremeely small changes in length; it must be self-recording; and finally, it must be capable of recording, accurately, deformations which take place very rapidly. With these thoughts in mind the graphic strain gage illustrated by Fig. 1 was developed. A study of Fig. 1 shows that this instrument consists primarily of a simple bell-crank lever attached to the frame of the instrument by means of a thin steel ribbon which serves as a knife edge and also as a spring. The end of the short arm of the bell-crank lever bears against a movable plunger. The long arm of the bell-crank lever is sharpened to a point which rests upon a smoked glass plate held by a spring clip to the frame of the instrument. A small movement of the plunger is multiplied approximately 75 times on the smoked glass record.

This instrument is used for stress determinations in concrete roads in the following manner: By means of a star drill, a recess about 6 in. long and ¾ in. in cross-section is cut in the top surface of the road. Small brass plates, having countersunk holes, are set in plaster of paris at the ends of this recess. The strain gage is placed in the recess, the movable plunger bearing

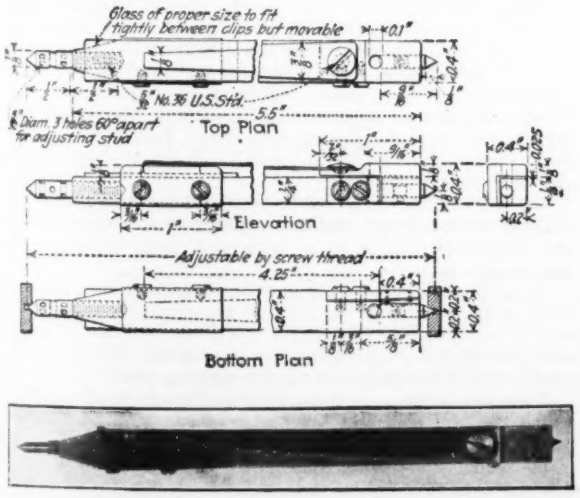


FIG. 1—STRAIN GAGE FOR FIELD TESTS OF CONCRETE ROADS
Gage set in 8x¾x¾ in. slot in pavement top gives records from which stresses due to truck load can be determined.

against one plate and the adjustable screw of the instrument fitting into the conical hole in the other plate. Adjustment is made until the needle is approximately in the center of the smoked glass plate. This plate is then slid along to that the needle scratches a short base line on the record. A sheet of steel, not more than ⅛ in. in thickness, is then laid on the road surface over the instrument and a motor truck is run over the instrument, if desired, or in any other position on the road. If a number of runs are to be made the same smoked glass record may be used for recording approximately ten runs. This is accomplished simply by sliding

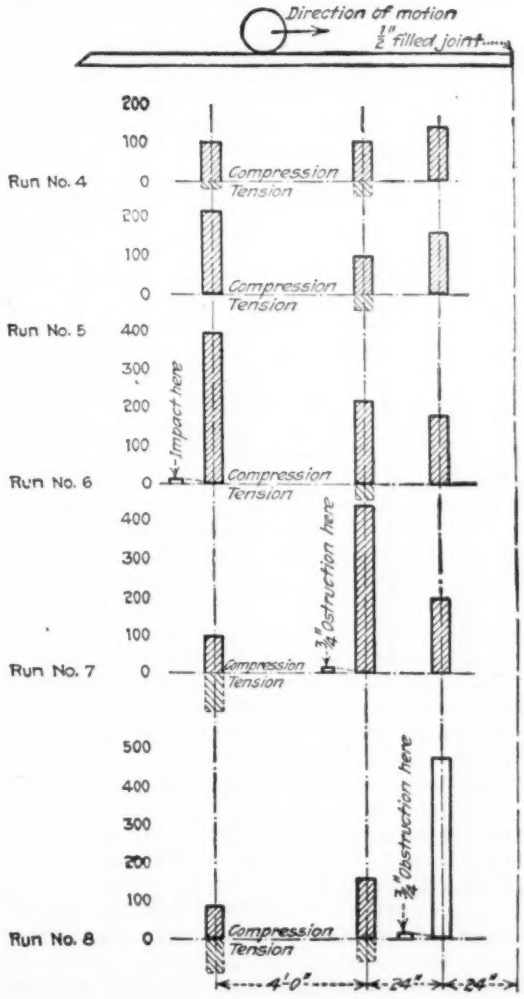


FIG. 2—TYPICAL RECORDS FROM STRAIN GAGE
Records show longitudinal stress on top of 6-in. plain slab 6 in. from side under 5-ton Packard truck.

the plate a small amount to change the position of the record.

The record thus obtained consists of a short line, part of which lies on one side of the base line, indicating tension, and part on the other side, indicating the maximum compression which was produced by the test run. The smoked glass plate is then removed from the instrument and is dipped into a very thin solution of copal varnish or of collodion, after which it may be handled without destroying the record. The record is properly marked and is later examined under a microscope to determine the length of lines recorded. These

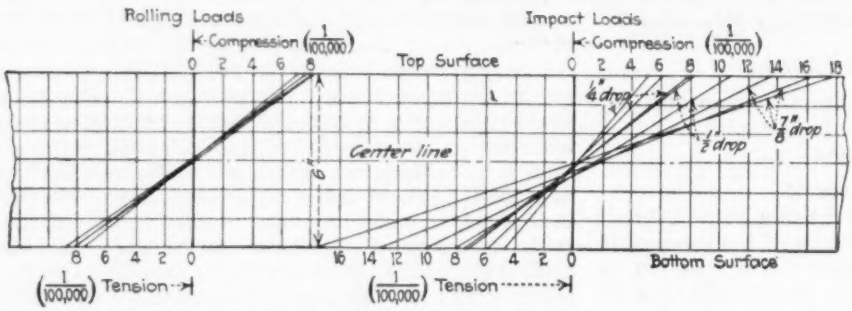


FIG. 3—CO-ORDINATION OF TENSION AND COMPRESSION

lines are directlty indicative of the stress produced in the concrete. In Fig. 2 there are shown typical records.

The ordinates above the horizontal base lines for the different runs indicate compression in the top fiber. The instruments were placed 6 in. from the side of the road in a longitudinal direction and were located with respect to a transverse joint as indicated by the dimensions given. The dotted ordinates below the base lines indicate tension in the top fibers. The high stresses in compression in the top fibers correspond to high stresses in tension in the bottom fibers. This is very well illustrated in Fig. 3 which shows tests made with two instruments, one installed at the top of the road, the other at the bottom. It will be seen here that approximately the same stress in tension is produced at the bottom of the slab as compression in the top of the slab with the neutral axis lying in the center.

Referring again to Fig. 2 there are shown some records in which the motor truck ran over a ⅞ x 4-in. strip of wood. The impact thus resulting immediately under the wheel is considerable. Referring to run No. 8 in which impact was produced by the rear wheel striking the road surface 2 ft. from one corner of the slab, there is shown to be high compression produced in the top fibers immediately under a wheel and therefore high tension in the bottom fibers. It is thus illustrated that even when the wheel is placed quite close to the corner of a slab high tension may be produced on the bottom rather than on the top of the slab. No doubt under favorable conditions the reverse condition of stress may result.

The one outstanding feature of the investigations thus far made is the fact that at the edge of the slab the highest stress in tension is apt to occur immediately under the wheel on the bottom of the slab, and at the corner of the slab high tension may also be produced in the top fibers.

From recent investigations on fatigue it would seem that if the fiber stress produced by loading exceeds approximately 50 per cent of the modulus of rupture of concrete, not very many applications of such high loads can be made without causing cracking of the concrete. On the other hand, if the loads applied produce a stress in the top or bottom fibers less than 50 per cent of the modulus of rupture of the concrete those loads may be applied a very large number of times without producing cracking. The fiber deformations measure the fiber stresses when the modulus of elasticity of the concrete is known, and if we wish to determine whether or not any particular concrete road is being over-stressed by heavy trucks this can readily be done by taking stress measurements such as I have described and the actual test procedure would require only a few hours.

It has been suggested also that by such measurements a highway department could determine quite accurately when to impose seasonal restrictions on heavy loads and when to withdraw such restrictions. It would seem that every highway department should know what factor of safety their concrete roads have under their legal limit of loading, and with the means now developed this information can be obtained with comparative ease.

Coatings That Prevent End Checks When Drying Lumber

WOOD dries more rapidly from the end grain than from the side grain, and is apt to check and split during seasoning unless end drying is retarded by some means. For this reason it is advisable to use a water-resistant end coating on wood during air seasoning or kiln drying, especially on woods which are difficult to dry and on short kiln samples. The Forest Products Laboratory, Madison, Wis., gives the following precautions:

Either the cold or the hot coatings can be used effectively for drying temperatures up to 140 deg. F. Temperatures much above this cause blistering in the cold coatings but make the hot coating plastic enough to form new surfaces as fast as the old ones break. For this reason the hot coatings are apt to be more effective than the cold coatings for temperatures from 140 up to 170 deg., where they liquefy to such an extent that they run off. No coating has been found which is entirely satisfactory for temperatures above 170 deg. Cold coatings are perhaps somewhat better than hot coatings for temperatures above 170 deg. and for use on kiln samples when the temperatures are high enough to cause the loss of part of a hot coating.

Cold coatings to be effective should have about the consistency of heavy syrup. The amount of filler required ranges from two to four parts by weight to one of the vehicle. Cold coatings used at the Forest Products Laboratory have been found effective about in the following order, the most effective being placed first: Hardened gloss oil and air-slacked lime with the oil evaporated to the consistency of thin syrup before adding the lime (very cheap); chinawood oil and barytes (cheap); linseed oil and white lead, very heavy (moderate cost); linseed oil and red lead, very heavy (moderate cost); high-grade spar varnish and barytes (expensive).

The hot dips are effective in the following order: 213-deg. coal-tar pitch (cheap); 254-deg. coal-tar pitch (cheap); rosin and lampblack, 100 parts of rosin to 7 parts of lampblack (moderate cost).

Some asphalts are highly moisture-resistant, but they are hard to apply because of the high temperatures required to make them plastic. Paraffine has proved satisfactory as an end coating for stock during air seasoning, but cannot be used in the kiln because of its low melting-point.

Excessive shrinkage of the wood and rough handling often cause the end coatings to chip or shear off, and a fresh application of the coating must be made.

To reduce end-drying sufficiently there must be a thick coating over the entire end surface. When hot dips are used, the wood should be dipped half an inch into the liquid.

Spread-Base Caissons in Boston Bank Foundation

Backfill Around Small Shaft Over Working Chamber Acts as Load to Assist Sinking of Caissons

A DEPARTURE from conventional methods of foundation construction has been made in the foundations of the First National Bank building, Milk and Devonshire Sts., Boston.

This building is shaped like a blunt wedge, 107 to 160 ft. wide and 260 ft. long, will have ten stories above the street and two below, and will have its lowest basement floor 33 to 49 ft. below the curb. The borings taken show hardpan at a grade varying from El. —35 to —37, or from 55 to 57 ft. below the curb. This hardpan is glacial till, composed of hard packed sand and boulder clay, and is overlain by a layer of fine sand varying from 8 to 10 ft. in thickness, above which is blue clay. The hardpan was at such a reasonable depth below the lower basement of the bank that it seemed wise to carry the foundation of so important a structure to this material.

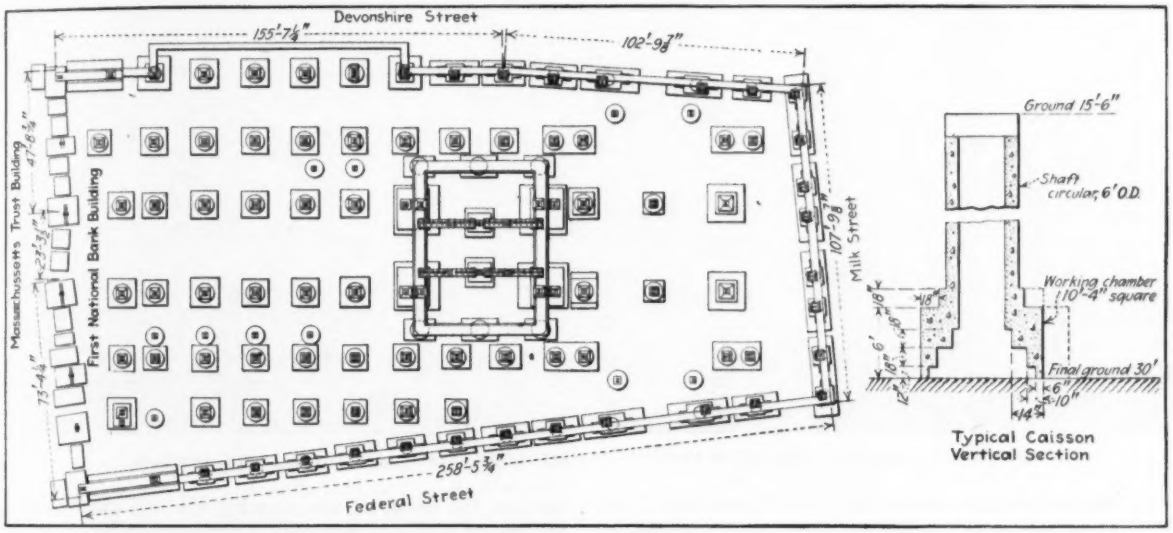


FIG. 1—CAISSON PLAN, FIRST NATIONAL BANK
Total number of caissons 104; depth from curb to hardpan about 55 ft., of which 8 to 10 ft. goes through fine, wet sand.

FIG. 2—TYPICAL CAISSON (VERTICAL SECTION)

It was found that the sand stratum was under a considerable hydraulic head, and could not be penetrated by open methods below El. —25 without loss of ground, which would be likely to do serious damage, as the surrounding heavy buildings rest on the clay above the sand.

Under these conditions a combination of open well and pneumatic methods was applied by means of a special caisson system devised by the Charles R. Gow Co., the foundation contractors. This system, for which patents are pending, represents a development by this firm of its ordinary method of sinking open caissons, resulting in the use of precast concrete caissons with working chamber larger than the superimposed shaft, a construction by which earth loading is used in sinking in place of external loading and the air leakage minimized. A typical section of one of these caissons is shown in Fig. 2.

In building such a caisson a starting pit is dug and sheeted the size and depth of the spread base. In the pit is cast the reinforced-concrete working chamber, which has no steel cutting edge. Over the working chamber is built a hollow concrete shaft, which forms the passage through which the soil is removed and which, when filled with concrete, becomes the pedestal for the steel column of the building.

While it was generally assumed that a load upwards of 8 tons per square foot on the hardpan was safe, in view of the lack of actual data it was considered important to definitely establish its bearing value. The first caissons were therefore designed on a basis of 5 tons per square foot, to give an extra margin of safety, and when sunk to the hardpan were utilized for making tests. The hardpan at this level is under a considerable hydraulic head, and while the material is very hard under normal conditions it readily softens under an unbalanced head. This was proven by the first two tests, which were made on unconfined bottom areas with the air pressure removed and relatively little water on the area being tested. Both of these tests developed serious settlement, as expected, the unbalanced head softening the hardpan so that it bore no resemblance to the hard, unyielding material which in compressed air could be flaked off only with difficulty by the use of a sharp miner's pick.

A third test was then made on a steel plate with its edges under a concrete seal 3 ft. thick, poured under compressed air. After this concrete had set and the air pressure and lock were removed, the caisson was immediately filled with water to approximately the normal hydraulic head, and a very satisfactory test was made, which proved that the soil was capable of supporting 8 tons per square foot without excessive settlement. However, in view of the importance of the structure and its intimate relation to surrounding buildings, a more conservative loading seemed warranted. Therefore, a unit soil load of 5 tons per square foot for the exterior and 5½ tons per square foot for the interior caissons was established as the basis of design.

This loading required caisson bases of varying sizes,

ranging from 6 x 6 ft. up to 10 x 31 ft. In all there are 104 caissons.

In preparing to sink the caisson, after the starting pit is excavated and the bell-base cast therein, a short section of shaft is constructed before further excavation is started. When this is properly set and the inside forms stripped, excavation is started from within, a portion of the excavated material being carried away and the rest deposited on the bell as it sinks, to increase the weight and as backfill. The weight of the caisson and the backfill is sufficient for sinking. According to Col. Gow of the contracting firm, with this form of caisson the deeper it sinks the easier it goes, due to the increasing load and the practically constant friction of the bell sides. As excavation proceeds, additional lengths of shaft are added as required; this process is continued until the condition of the bottom becomes hazardous.

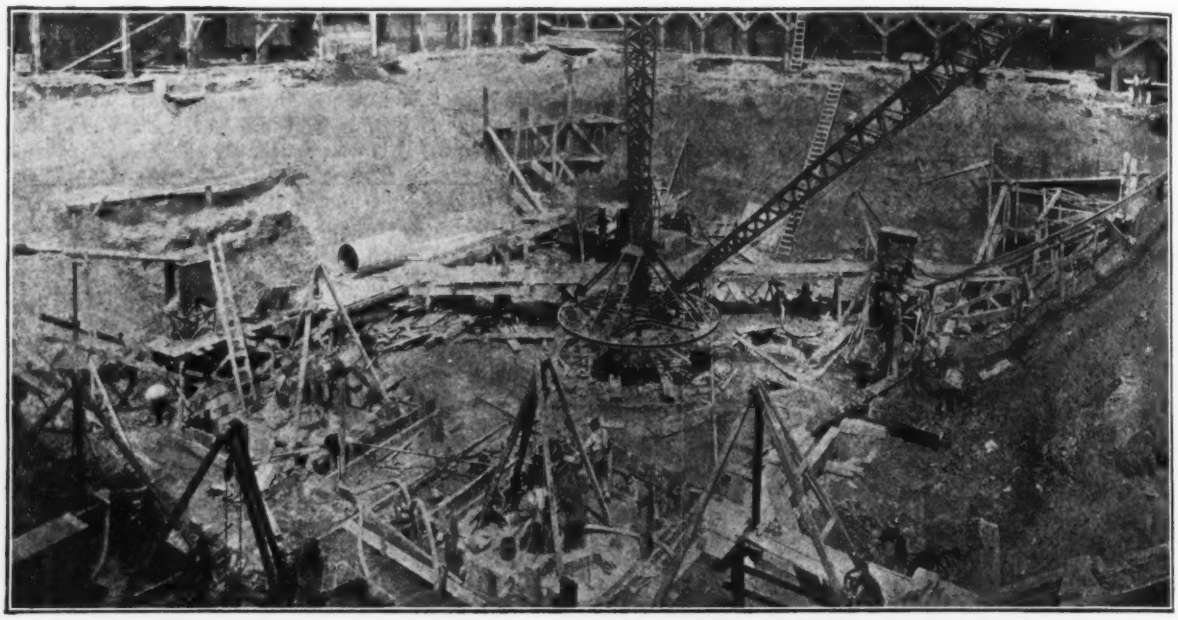


FIG. 3—FOUNDATION SITE AT START OF CAISSON WORK, FIRST NATIONAL BANK, BOSTON

FIG. 4—BAGS OF EARTH READY FOR HOISTING FROM WORKING CHAMBER

At this point two steel diaphragm lockheads are set and bricked in the shaft, thus forming an air lock, and the balance of the excavation is carried on under air pressure, varying from 10 to 18 lb. per square inch. Muck is taken out in heavy canvas bags instead of in buckets as before, as these bags are more easily stored in the confined space within the lock.

The caissons under air are lowered by momentarily reducing the pressure and thus utilizing what might be called air hammer in addition to the weight of the caisson and backfill to force the drop. The caissons are at all times kept on line by bracing the shafts against the sides of the starting pit and undercutting rapidly at points which show a tendency to lag.

When hardpan is thus reached all the overlying material is cleared and reasonably leveled. A concrete seal of proper thickness is placed, and allowed to set 24 hr. under pressure, at a temperature of about 80 deg. F. When this has been done, the lockheads are removed and the balance of the caisson is concreted. To date practically all the caissons for half the building are complete and the method has worked out very satisfactorily.

The methods applied on this work were in fact a development from the open caisson system known as the "Gow caisson pile" originally designed by Col. Gow for underpinning buildings along the Washington St. subway, in Boston. It consists of excavating in the open with the aid of telescoping steel cylinders driven down one inside the other as excavation proceeds, until the desired stratum is reached, and then constructing the footing by belling out from this shaft—with or without the use of sheeting, dependent on the material in which the belling is done—in somewhat the same manner as employed in the Chicago well system.

The First National Bank employed Stone & Webster as general contractors, for whom the Charles R. Gow Co., New England agents of the Raymond Concrete Pile Co., devised the methods and are the foundation subcontractors. York & Sawyer are the architects for the bank and H. G. Balcom is their consulting engineer.

Records of Walking Dredge Work in Delta Land Drainage

Best Results Shown in Dry Digging—Wet Weather Causes Trouble—Delays Classified—Comparison Made With Floating Dredges—Combined Plant Superior

By Albert S. Fry
Morgan Engineering Co., Memphis, Tenn.

WALKING dredges were used to excavate approximately 3,000,000 cu.yd. of earth in constructing 113 miles of drainage channels in the Black Bayou and Murphy Bayou drainage districts in Washington County, Mississippi. Comparison of these machines with floating dredges and records of output and particularly of delays make this work of special interest to drainage engineers and contractors.

Material and Equipment—The soil ranged from a sandy loam to a stiff wax gumbo. The greatest width which the machines could span was about 30 ft., which limited the maximum base width to 12 ft. with the side slopes fixed at 1 on 1 and with depths ranging up to 8 ft. Excavated material for the greater part of the work was deposited on both sides of the channel leaving a berm 10 ft. wide between the margin of the excavation and the toe of the spoil bank as shown in Fig. 1. Openings for drainage into the new channels were left at intervals of approximately 500 ft. On part of the work, the "walkers" were used to make a pilot cut down the line of a ditch too large for the machine to excavate full size, and in this case all of the spoil was thrown on one side of the channel, leaving the other side free to receive the balance of the excavation which was done by a floating dredge. These machines are known as cross-walking dredges.

Each machine consisted principally of a wooden deck wide enough to straddle the excavation and strong enough to support the machinery, the load from the deck being carried through a large wooden truss, Fig. 2, on each side to four wooden shoes at the corners. These shoes support the machine while it is working. Midway between each pair of side shoes is a similar shoe which is arranged on a sliding mechanism and does not move with the machine.

When ready to walk, the machine is raised so that its weight is resting pivoted on the center shoes and is removed from the corner shoes. The entire machine then slides forward and the weight is again brought onto the corner shoes. The center shoes are returned to position and the machine is ready to walk again or to continue excavation. Each machine had a boom 42 ft. long and a bucket rated at 1½ cu.yd. The bucket is a shovel or pan, the general shape of which is shown by Fig. 3 and which excavates about double its rated capacity by reason of its shape and the method of digging. The distance between the inside of the shoes was about 30 ft. for machines 1 and 2, the Black Bayou District dredges, and 32 ft. for Machine 6, the Murphy Bayou District dredge.

Each machine was operated by oil engines. The crew consisted of four men: a shovelman of considerable experience to operate the levers which control the hoist and backing lines with which the digging is done; a craneman to control the swinging and dumping movements; an engineer to run the engines and look after the machinery, and an oiler. In addition, a teamster was required to haul fuel and supplies, and a dynamite man to blast stumps from the path of the excavator. There was also a man in charge of each machine.

In building Machine 6, as a result of experience with Machines 1 and 2, the distance between shoes was increased because the first two machines had difficulty in doing satisfactory work on the maximum size of ditch where top width and width between shoes are the same.

Progress and Output—All three machines maintained good rates of progress after they were once in operation, considering the conditions under which they had to work. Machine 1 completed its contract on Nov. 21,

FIG. 1—DITCH DUG BY WALKING DREDGE
Shoes of dredge form well packed berms on each side of the ditch.

1920, Machine 2 on Dec. 27, 1920, and Machine 6 about Sept. 15, 1921. Table I shows the total work done by each machine together with the average monthly progress. In this table, 25 days are deducted from the total time Machine 6 was on the job for time that it was digging on another job. The progress of the three machines is shown graphically in Fig. 4.

The best individual record was made by Machine No. 2 excavating five miles of new channel in five weeks, about 125,000 cu.yd. which is a monthly rate of 100,000 cu.yd. This record was made under most favorable conditions for a machine of this type straightaway digging in dry ground. The channel excavated had a bottom width of 6 ft. for the upper two miles, 8 ft. for the next two miles, and 10 ft. for the fifth mile. The depth of excavation averaged about 8 ft. and the maximum depth for a short distance was 10.2 ft. Following this record, the machine slowed up, but in the succeeding three weeks such a rate was maintained that during the first eight weeks of operation 166,000 cu.yd. of earth were moved at a monthly rate of 83,000 cu.yd. During this time, 6.6 miles were excavated, 3.3 miles per month.

Machine 6 exhibited the second best monthly record by excavating 89,600 cu.yd. in March, 1921. Four miles of channels were dug, the bottom widths ranging from 6 to 12 ft. and the depths from 7 to 9 ft. In September,

1920, this machine excavated 87,300 cu.yd. from a ditch with a bottom width of 12 ft. nearly equalling its best record.

Machine 1 made no monthly record that approaches either that of Machine 2 or Machine 6; it did, however, perform more consistently over the length of its contract than the other machines. Its best record was set for the first five months of 1919 when 273,600 cu.yd. were excavated at a monthly rate of 54,700 cu.yd., about 2¼ miles of new channel being excavated per month.

Delays Recorded—A record was kept by the resident engineer of the time lost by each machine whenever this time was as much as a day. The progress chart Fig. 4 shows the durations of and reasons for the principal delays, but the scale is such that delays of less than about 7 days cannot be shown. On each job there were, of course, many delays of a few days which are not apparent on the chart.

The delays recorded were of four general classes: (1) Walking the machine across country from a completed ditch to the beginning of excavation on another ditch; (2) soft condition of the ground and high water in the ditches; (3) repairs to the dredge or its machinery; and (4) scarcity of labor and epidemic sickness of the crew forcing a shutdown. The percentage of total time, counting from the date each machine began excavation, consumed by delays is shown for each dredge by Table II.

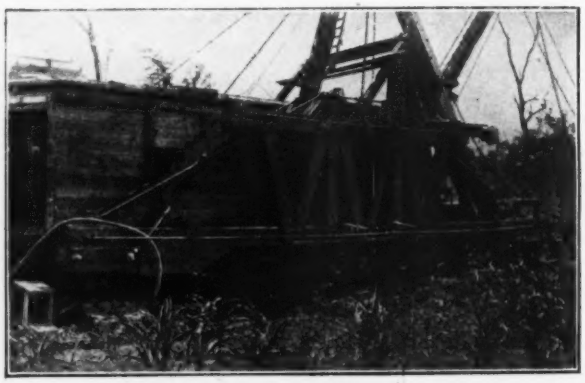


FIG. 2—SIDE TRUSSES CARRY LOAD TO CORNER SHOES

It will be observed that each machine lost nearly the same per cent of time in moving from one piece of work to the next. The layout of the ditch systems was such that the distance between the end of work on one ditch and the beginning of work on the next was usually from 1 to 2 miles. This distance was ordinarily walked and the machine was digging again in from 3 to 8 days. In a few instances, however, considerably more time was lost. For example, Machine No. 6 lost 25 days in walking between the heads of two ditches only about 1½ miles apart, the boggy nature of the ground near the upper end of one of the ditches making it almost impossible for the machine to go through.

Soft or wet ground is probably the greatest drawback that walking machines have in excavating ditches in the kind of country found in the Mississippi delta. When the ground is dry and firm, a walking dredge can move along at a rapid rate but when the ditch location runs through especially low boggy ground or follows a bayou the great weight makes operation very difficult and uncertain and results in miring. After rains, the soil on the berms becomes soft and slippery. At such time, the machines had considerable difficulty in working and several times were unable to keep their footing and slipped into the ditch. Excessive rainfall which produced high stages of water in the low bottom lands and in the ditches made working practically impossible and it was necessary to suspend work until the waters had gone down. Machines 1 and 2 were delayed only a few days by high water as they were favored by unusually dry weather during the greater part of the time they were at work and the time lost by these two machines for the second cause of delays represents almost entirely delays from having to go through boggy ground or bayous or from slipping into the ditch.

Repairs occupied from 9.3 to 12.9 per cent of the total operating time. The repairs necessary were such as might be expected in the operation of the machines on the kind of work performed.

Machines 1 and 2 began work in the early part of 1918, at which time labor was scarce owing to the war. However, no great amount of time was lost from this cause. Common labor to clear the right-of-way ahead of the machines was scarce and was also inefficient and on occasions, the dredges were delayed for short intervals waiting for right-of-way to be cleared ahead of the machine. The first influenza epidemic attacked practically all the men in the crew of Machine 1, and 11 days were lost on that account. Machine 6 lost practically no time from lack of labor, the only occasion being a few days for the crews to celebrate on holidays.

Comparison With Floating Dredges—The chief advantage of walking dredges lies in the fact that the upper ends of drainage systems can be dug to the size required to fit into a balanced drainage plan. In the past, in the South, the floating dredge has been the chief means used for digging the upper end or lateral canals as well as the larger outlet canals of a drainage system. This has been because the floating dipper dredge has been the cheapest known method of excavating earth channels and it has been cheaper heretofore to pay for the volume of excavation in the minimum sized ditch that can be dug by a small floating dredge than it has been to excavate a smaller ditch by some other means.

The weight and amount of machinery on the smallest dipper dredges in use are such as to require a width of hull which necessitates digging a ditch about 12 or 14 ft. on the bottom with side slopes of 1 to 1 or ½ to 1 in order to permit the passage of the hull. From a hydraulic standpoint, a ditch of this size is not required for the upper few miles of each lateral ditch in an economically planned drainage system for flat lands. The construction of such ditches by floating dredges to over-size dimensions has resulted in the unbalancing of many drainage systems by funnelling the runoff from excessive rains down these upper ends of canals to the detriment of the lands farther down stream where the limits of economic drainage have permitted the construction of channels which are only large enough to take care of the amount of water required by the hydraulic basis of design and which are not of sufficient size to carry off, without over-

TABLE I—PROGRESS SUMMARY OF WALKING DREDGE WORK

Machine No.	Total Exc. Cu.Yd.	Total Miles Exc.	Total Months On Job	Aver. Per Month Cu.Yd.	Aver. Per Month Miles
1	867,700	32.8	19	45,600	1.7
2	1,114,100	41.6	22.2	50,290	1.9
6	1,092,000	39.8	23.6	46,300	1.7

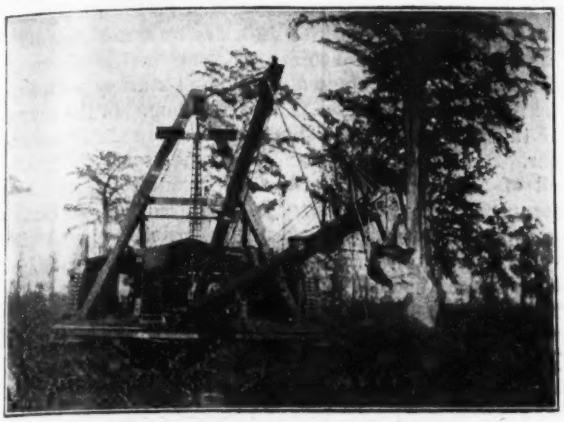


FIG. 3—FRONT VIEW OF WALKING DREDGE

Dipper shaped and operating like a scoop has considerable overload capacity.

flowing, the amount in excess of the hydraulic requirements which comes down from the upper canals. Furthermore, a floating dredge must be large enough to dig the channels which lie between and connect the upper ends of the canal system and furnish outlets for these upper ends. The size of the connecting channels is usually determined by hydraulic requirements and a dredge large enough to dig these channels is of such size that it must excavate the upper ends of the laterals oversize.

The walking dredge offers a solution to this difficulty and by its use on the upper ends of lateral canals, a perfectly balanced drainage system can be constructed. Ordinarily the absolute cost is not increased for it is quite usual in walking dredge excavation to pay for the volume of material that would be paid for if the work was done by a floating machine. In both the Black Bayou and Murphy Bayou Districts, the contractor received payment for ditches with a bottom width of 12 ft. although the actual widths constructed were 6, 8, 10, and 12 ft. depending on the hydraulic capacity required.

Another virtue of the walking dredge as compared to the floating dredge is that it requires no water. There are probably few drainage districts where construction has not been seriously delayed by the lack of sufficient water to float the hulls of dipper dredges. In the Black Bayou District, the walking machines were making steady progress while floating dredges were forced to lie idle for several months because the time when the latter were ready to start work was during one of the driest periods ever known in central Mississippi.

One other advantage of the walking dredge is its flexibility in moving from one ditch to another. A floating dredge must dig a connected system of drains as floating is the only means of transportation which the dredge has without the dredge being torn down and rebuilt. The walking dredge can dig a disconnected system of ditches and can dig a few miles on the upper end of one channel, then walk across country a mile or more if necessary to the upper end of another channel and thus progressively excavate the upper ends of the ditches.

This ability of the walking dredge to travel across country from one ditch to another also permits of different design of a drainage system than where floating equipment is used. In the latter case, the canal system must be so laid out that the ditches in any job to be done by one machine form a connected system which the machine can dig by floating its way around on all of the work. Where a walking dredge can be used, the designer is free to lay out a ditch system without the necessity of the ditches connecting. This may be of decided advantage in certain cases. For example, Fig. 5 shows a rearrangement of some of the channels in the Murphy Bayou District that was made after it was found that a walking dredge was to be used for part of the work. At the time the drainage system was designed, it was not known what type of machinery would be used for construction and consequently the design was made so that floating equipment could be used. After the contract was let for the work to be done by walking machines the ditches shown in the sketch were relocated. About 1,500 ft. of Ditch 9 were omitted just below the junction with Ditch 10, and Ditch 10-A was added to furnish a new outlet for the upper part of Ditch 9 and for Ditch 10. This change made possible a better drainage unit in so far as Ditches 9 and 10 were concerned, and also relieved the main outlet for the district from taking care of the drainage from these ditches. It also permitted the raising of the grade line and the decrease in size of the lower end of Ditch 9, which made possible a desirable re-location not feasible under the original layout. The net result was a better design and a saving in cost.

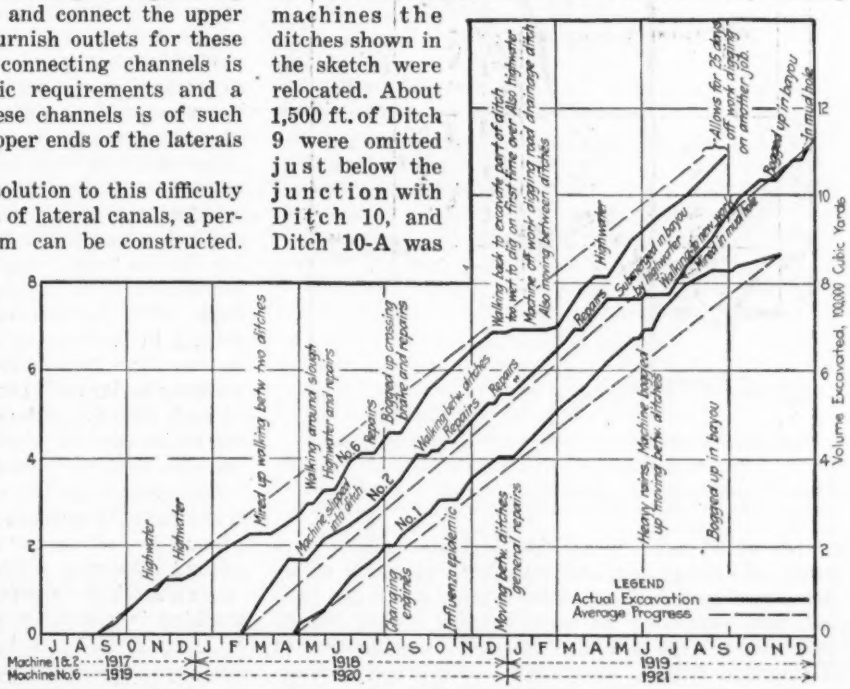

Volume Excavated, 10,000 Cubic Yards
0
2
4
6
8
10
12
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
Machine 1& 2 ---- 1917 ---- 1918 ---- 1919 ----
Machine No. 6 ---- 1919 ---- 1920 ---- 1921 ----
Highwater
Highwater
Mired up walking betw. two ditches
Walking around slough
Highwater and repairs
No. 6
Repairs
Bogged up crossing
brake and repairs
Machine slipped into ditch
No. 2
Walking betw. ditches
Repairs
No. 1
Changing engines
Influenza epidemic
Walking back to excavate part of ditch to west to dig on first time over also highwater
Machine off work digging road drainage ditch
Also moving between ditches
Moving betw. ditches
general repairs
Repairs
Submerged in bayou by highwater
Waiting for new spuds
Mired in mud hole
Allows for 25 days off work digging on another job
Bogged up in bayou in mud hole
Heavy rains, Machine bogged up moving betw. ditches
Bogged up in bayou
LEGEND
Actual Excavation
Average Progress

FIG. 4—PROGRESS CHART OF DREDGE OPERATIONS

Delays noted are summarized according to four principal causes in Table II.

There are many drainage units that do not require the construction of ditches larger than a walking dredge can dig and where this is true, the system can ordinarily be completed sooner with this type of machine. It is

also possible to partially excavate outlets down channels where the finished width is greater than the machine can dig, the excavated spoil all being deposited on one bank and the channel ultimately being excavated to full size by a floating dredge or other excavator, placing the balance of the material on the opposite bank. This plan of operation sometimes serves to furnish a partial outlet for a drainage unit at an earlier time than would be possible if it were necessary to wait for the work to be done by a floating excavator. This was done in the Black Bayou District when a walker made a pilot cut on

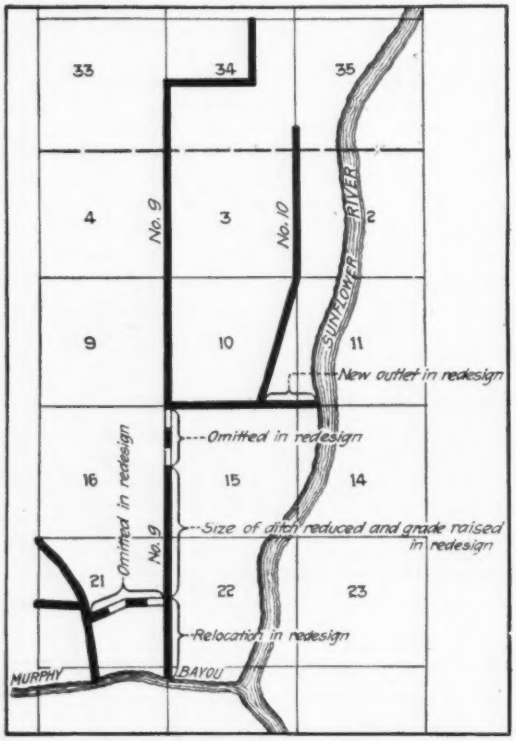


FIG. 5—REDESIGN OF DRAINAGE UNIT

Use of walking dredges capable of traveling overland made it possible to reduce size and to omit connecting ditches.

a large outlet canal to provide a partial outlet for a system of ditches dug by the walker and which otherwise would have had no outlet until a floating dredge could have excavated the whole channel several months later. In a large drainage district a combination of walking and floating excavators will provide drainage and complete the work quicker than will floating equipment alone.

Naturally the walking dredge has its drawbacks. Most troublesome of all is the leaving of short dams across a ditch for the machine to walk upon when required to cross the ditch. For example, the dredge may have excavated a lateral ditch for a few miles down to the junction of this lateral with its outlet canal, the latter having been already dug by a floating dredge or other excavator. The walker will then leave a dam across the lateral, usually about 40 or 50 ft. long, but sometimes even longer, to walk upon in leaving the ditch.

Dams were left in some cases at curves in the ditches because of the inability of the machine to make a short turn and cut the ditch around the curve. When heavy rains fill the new excavation behind the walker, the difficulties of excavating from under water coupled with the advantages of working in a dry or almost dry ditch are such that the machine will leave a short dam of earth to hold back the water and will start new excavation on the downstream face of the dam. In the course of the whole job, these short dams accumulate in number. Before final acceptance, it is necessary to remove all of these dams by means of dynamite, teams, and scrapers, or men and shovels. The dredge itself cannot go back over the work because it is not equipped with backing machinery. On one ditch plugs were left at intervals of about every quarter of a mile, the plugs being removed later on by a floating dredge following down the ditch from another part of the work.

There is nothing difficult in the actual removal of such dams of earth but it is one of those little things on a big drainage job that the resident engineer usually finds it hard to have done. These dams represent small pieces of work scattered over a big area and are usually fairly inaccessible so that the contractor needs considerable urging to remove them.

The operation of walking dredges is also hindered to a certain extent by the fact that the machines can only travel forward. It is absolutely necessary to complete the work the first time over or finish it by other means.

Walking dredges are greatly handicapped when forced to work in boggy ground or bayous or to work after heavy rains which soften the top soil and make the footing slippery and insecure. The machines are very heavy and mire down badly in soft ground. The record of progress and delays previously discussed brings out this fact very clearly. In some cases in soft ground logs and poles were laid on the berms to make better footing for the shoes. This practice proved objectionable, however, because the logs and poles would fall into the ditch. The performance of the machines in digging ditches in bayous and very low boggy ground demonstrates that these machines are not well adapted to working under such conditions, although short sections of such ditches can be excavated as parts of contracts, the major part of which consists of work to which the machine is better suited.

The great weight of the machines on the berms sometimes tends to produce caving of the banks where the ground is soft or unstable. Slippery berms, even on ground otherwise solid, after rains are also likely to cause a machine to slide into the ditch. Extricating the machine is a difficult and costly task and delays the

TABLE II—SUMMARY OF MAJOR DELAYS

	—Total Days Lost—			Per Cent of Total Time Lost		
	Mach. No. 1	Mach. No. 2	Mach. No. 6	Mach. No. 1	Mach. No. 2	Mach. No. 6
Moving dredge	34	48	57	5.9	7.1	7.9
Ground soft or wet	44	106	95	7.6	15.7	13.2
Repairs	60	87	62	10.4	12.9	8.6
Labor scarcity and sickness	22	13	4	3.8	1.9	0.5
Totals	160	254	218	27.7	37.6	30.2

work. One of the machines in the Black Bayou District partially overcame this disadvantage by removing with the shovel the wet slushy material from the surface of the berms before moving forward, scraping off in this way just enough earth to get down to a solid footing.

High water in the excavated channel usually forces a shutdown until the water recedes. Some work was done by all three machines with the ditch filled or nearly filled with water but the water was a handicap and

progress was slow. As mentioned before, the method of leaving dams in a ditch to hold back the water was resorted to in such cases. The walking machine prefers just enough water in the ditch to make the dipper shed well.

The Black Bayou dredges were built to span a top width of about 30 ft. and the Murphy Bayou machine about 32 ft. In certain cases, where the bottom width was 12 ft. and the cut was more than 8 or 9 ft. the machines were unable to span the full top width of ditch. In such instances, shoe tracks were cut down on either side of the ditch to such a depth as would reduce the width to be spanned to the distance between shoes. This inability to span the ditch made it necessary to cut down sometimes 3 or 4 ft. into the berms. Where this was done, the actual width of unexcavated berms was necessarily reduced. The practice of benching down into the slopes of the ditch was not especially desirable but was the only way that the work could be done by the machine. This kind of construction also made necessary the excavation of considerable yardage in excess of that required which necessarily tended to delay progress, increase the cost to the contractor, and make larger spoil banks than would result from the actual ditch prism itself. Constant vigilance was required by the resident engineers and inspectors to prevent the machine operators from cutting the top width too narrow where the width was nearly the same as that of the machine span.

A point that may be mentioned as affecting the relative cost of work done by a floating dredge or a walking dredge is that the clearing ahead of the latter within the top width of the channel is more costly because the stumps must be blasted out. The enormous strength of the floating dredge enables stumps of huge dimensions to be lifted or nosed out of the channel section with little or no blasting required.

The work was carried out under the supervision of the Morgan Engineering Co., Memphis, Tenn., under the direction of Ned H. Sayford, vice-president. E. C. Wild was resident engineer on the Black Bayou District and T. P. Anderson was resident engineer on the Murphy Bayou District. The contractor for all the work was the J. B. Arpin Dredging Co. of Grand Rapids, Wis.

Results of Water Waste Survey in Detroit

A three-year pitometer survey of water waste in Detroit, Mich., resulted in a saving of 22.5 m.g.d. or 24 gal. per capita. Of this, 9.5 m.g.d. was underground main leakage, 3.4 m.g.d. unmetered fixture leakage and 9.6 m.g.d. metered fixture leakage. These figures are given in the latest annual report of George H. Fenkell, superintendent and general manager. He states, with reference to the extent to which metering reduced house waste, that while universal metering has not entirely eliminated house waste it has helped to reduce it considerably. Metering reduced the quantity used for sprinkling, for cooling in summer and for preventing freezing in winter but it had not materially reduced the waste through defective and leaking fixtures. Of 33,906 services investigated for leaking plumbing fixtures 50 per cent were found wasting through leaking toilets, taps, etc. Upon notice of defective fixtures owners of unmetered services in most cases were found 10 days later to have had repairs made. The yearly saving uncovered by the survey netted $204,000.

A. A. E. Helps to Expose "Chief Draftsman Dobe"

Interests Advertising Clubs in Unfair Advertising Which Is Vigorously Condemned by Vigilance Committee

FOR a number of years advertisements similar to the following have been appearing in different papers throughout the country.

> MEN WANTED to become draftsmen —Salary $250 to $300 monthly when competent. Chief draftsman will train you at your home, also furnish FREE all *tools*. Training given until in position at above salary. Address Chief Draftsman Dobe, 1951 Lawrence, Div. 75, Chicago.

In 1918 members of the American Association of Engineers became concerned about this advertising and began to urge the Association to cleanse advertising of misleading statements concerning educational qualifications and salaries of engineers.

In the fall of 1921 resolutions passed by the Philadelphia Chapter and a letter from Robert W. Shelmire came before the National Executive Committee, which pledged the association to do all in its power to stop such misleading advertising and directed that in such endeavors the assistance be enlisted of the Associated Advertising Clubs of the World and the United States Post Office. A committee of the Chicago Chapter consisting of W. A. Artingstall, chairman, Paul Hansen, and Robert W. Shelmire, was appointed to collect data for the assistance of the National Vigilance Committee. Since then the Association has been active in its efforts to get action in the case but has not been successful until last month when the National Vigilance Committee of the Associated Advertising Clubs of the World issued as its Bulletin No. 48 the following:

"Chief Draftsman Dobe" purports to be an experienced employer of draftsmen for a large and well-known firm of engineers. He offers to train personally (by correspondence) candidate student draftsmen.

Advertising extensively in magazines, "Chief Draftsman Dobe" tells an interesting story.

By assembling various statements taken from the Dobe copy and follow-up literature, it is found that a 15-year-old boy with ability to read, write, use figures and follow instructions, can study under Dobe for the equivalent of three to six weeks of solid eight-hour days, and then be prepared to earn, and in fact, is guaranteed a salary of $250 to $300 a month with $450 on the side at home.

A magnificent set of drafting tools are advertised "Free" as an inducement to prospective students. However, the approximate sum of $65.00 is charged for the course and must be paid before the "free tools" belong to the student.

Investigation of the truth of the claims that positions paying $250 to $300 per month will be available to Dobe graduates, shows that not one of a number of engineering contractors will retain a draftsman in a permanent position paying $250 a month without years of experience.

The "Chief Draftsman Dobe" copy is exceedingly misleading. Young men expecting exceptional results are disillusioned because of the exaggerated promises made. The so-called "Free Offer" is used in direct violation of the recommendations of this committee inasmuch as the "Offer" cannot be acquired without the expenditure of money.

The confidence of the public and the reputations of the advertising and engineering professions are ridiculed and belittled by advertising of the "Chief Draftsman Dobe" type.

A Study of Office-Building Live-Loads

Weighings of Occupancies in Equitable Building Show Average Loadings Ranging From 1 to 87 Pounds Per Square Foot

With an introduction by Ira H. Woolson, Chairman, Building Code Committee, Department of Commerce

The following article, based upon a study made by C. T. Coley, manager of the Equitable Building, New York City, describes a survey made of existing floor load conditions in that building, the most complete study of its kind of which I have knowledge. The work was undertaken at the request of the Building Code Committee of the U. S. Department of Commerce. The efficient thoroughness with which this work was done is plainly evident.

The committee has received numerous requests to standardize building code requirements for allowable floor loads in all ordinary occupancies. Existing requirements are widely variant, even in cities near each other. These variations result in annoyance and confusion to architects and engineers, and, so far as such requirements are unduly severe, they waste material and uselessly increase building costs. The committee desires to comply with these requests, and to this end is endeavoring to secure all possible information of actual floor load analyses or calculations upon every kind of occupancy, except that for private dwellings, which is of minor importance and has already been treated in an earlier report.

Very little is found in print upon the subject. A search of the libraries of Congress and of the United Engineering Societies revealed practically nothing upon the weight of ordinary commercial or industrial occupancy, except some excellent studies of office occupancies made by C. H. Blackall, of Boston, and an extensive analysis of loading due to motor truck storage, by E. L. Verveer, *Engineering News-Record*, Feb. 9, 1922, p. 238). The weight of human beings in congested and freely moving masses has also been quite well determined by Prof. L. J. Johnson in this country and Prof. W. C. Kernot in Australia. Prof. C. J. Tilden (*Transactions*, American Society of Civil Engineers, 1913), also made rather extensive studies of the impulse effect of moving masses of people in sitting, rising, and rapid movement from one position to another, as on bridges or boats.

Doubtless many investigations of floor loading have been made for private purposes in various classes of occupancy, and if copies of these could be obtained for Secretary Hoover's Committee they would be of real service in its work. Office building loadings are now fairly well covered, though additional information would be helpful. We are greatly in need of data on loadings in schools, churches, hotels, assembly halls, theatres, hospitals, workshops, factories, printing establishments, machine shops, public garages, etc. If a person has any floor load studies and has not the opportunity to have the work duplicated, but would be willing to loan the material to the committee, it would be very gladly received and promptly returned after being summarized. It is also hoped that this appeal may stimulate others to make similar surveys in some of the above name occupancies for the aid of the committee. IRA H. WOOLSON.

New York, Feb. 28.

DURING the latter part of 1922, a detailed investigation was made of live-loads on several floors of the Equitable Building, New York City. This structure is well known as perhaps the largest office building in the world, and the varied nature of its occupancy made observations possible which should be useful in the design of future office buildings and proper regulation of those already in use. The study was instigated by the Department of Commerce Building Code Committee, which is investigating the possibilities of greater economy in structural design, and the objects were to determine the maximum, minimum and average floor loads existing in actual office practice; the nature and distribution of such loads; and the relations which they should bear to the assumptions for design of floor slabs, floor beams and columns as governed by prevailing building code practice. With this in mind it was necessary to determine the actual weights of office furniture and merchandise, also its location with reference to partitions and floor beams. In order to cover a wide range of usual office building occupancies, three floors were selected, representing light, medium and heavy classes of occupancy, and the entire area of these three floors was surveyed. Several other offices on various floors, representing what appeared to be unusually heavy occupancy, also were investigated. The whole survey covered over 200 rooms.

The investigation was planned and supervised by C. T. Coley, M. E., manager of the building. A force of five men equipped with platform scales and field book spent several days weighing and tabulating every article of furniture within the areas mentioned. Sketches were prepared for each office, showing the location and weights of all articles of furniture, so that the distribution of loads could be quite closely determined. Figs. 1, 2 and 3 are typical examples of these sketches.

General Results — Following is a brief tabulation showing the outstanding features of the report on this study; Fig. 4 also summarizes the observations graphically. It will be noted that little difference exists in the average loading of the floor selected as the heaviest in the building and that which appeared at first glance the lightest.

MAXIMUM, MINIMUM AND AVERAGE LIVE-LOADS IN EQUITABLE BUILDING

	No. of Offices	Maximum Lb. Sq.Ft.	Minimum Lb. Sq.Ft.	Average Lb. Sq.Ft.
Light occupancy floor (20th)	67	55.4	.87	10.26
Medium occupancy floor (37th)	64	30.73	3.27	10.67
Heavy occupancy floor (11th)	62	33.84	5.00	13.96
Total and average	193			11.6
Selected heavy occupancies throughout building	14	78.3	21.4	42.4

The weights given do not include the radiators, which averaged 200 lb. each, with two to each bay, located under the windows. These would add approximately 1 lb. per square ft. for all exterior bays.

The weight of the partitions was not included in the calculations. These in general are 3-in. hollow tile plastered each side, and a careful weighing of one which was being removed showed a weight of 30 lb. per square foot, or approximately 350 lb. per running foot.

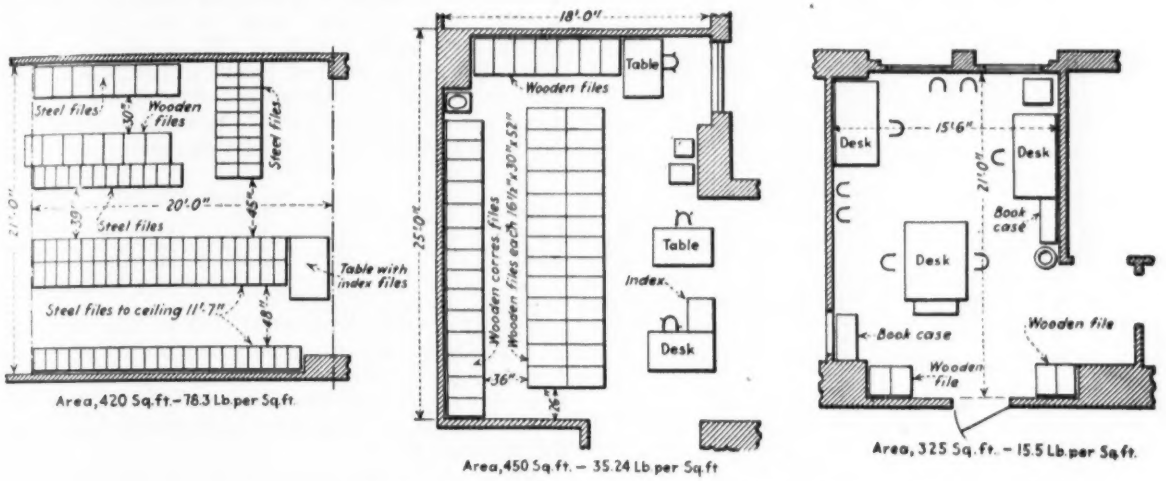
The weight of occupants has been taken at 150 lb. per person, which figure is probably too high, as a considerable portion of such occupants is females, whose average weight probably would not exceed 120 lb.

Discussion of Results—The careful sketches of load arrangement make it possible to throw some light on the prevailing method of assuming uniformly distributed live loads as a basis for floor design, and help to indicate what relation such assumptions should bear to actual total loads. Examination of bays for which the live load was more than 25 lb. per square foot shows wide variation in the distribution of such loads. The larger proportion was found, as might be expected, within

a zone approximately 3 ft. wide around the walls, the remainder being distributed variously in the centers of the rooms. In one or two cases, however, the major proportion of all the load was situated away from the walls and this condition must be provided for by designers. There is also the probability that practically all furniture may be collected in the central portion of a floor area when occupants are moving, or when painting or cleaning is in progress. The sketches show that the heavier loads, such as library shelves and double filing cabinets, are likely to be located away from walls and partitions, obviously for ease of access.

cases with contents weighed much more, but these weights were distributed over such a large area that they could not be regarded as concentrated. Of 35 safes and safe cabinets, 22 weighed less than 1,000 lb.; 5 between 1,000 and 2,000 lb.; 2 each weighed 2,200 lb. and 2,360 lb.; one each weighed 2,800 lb., 3,000 lb., 3,500 lb. and 4,250 lb. This seems to indicate that if care in regulation of occupancies were exercised, considerable economies might be possible in providing for concentrated loads. To what extent such regulation is practical is a matter for deliberation.

As would naturally be expected, the live-loads were



FIGS. 1 TO 3—TYPICAL OFFICES WITH HEAVY TO LIGHT OCCUPANCY

Fig. 1—File Room of Bonding Company

Summary of Loads.

		Lbs.
	Floor covering, linoleums	630
2,178	File drawers, 10 lb.	21,780
	Racks for same	4,300
2	Card cabinets, 100 and 300 lb.	400
6	Card cabinets, 50 lb	300
1	Flat top desk	200
7	Steel file cabinets, 340 lb.	2,380
7	Steel file cabinets, 200 lb.	1,400
5	Wooden file cabinets, 250 lb.	1,250
5	Step ladders, 50 lb.	250
	Total	32,890

Total floor area, 420 sq.ft.
Load per sq.ft., 78.3 lb

Fig. 2—File Room of Electric Company

Summary of Loads.

		Lbs.
	Floor covering, linoleum	675
47	File cabinets, 300 lb.	14,100
2	Tables @ 150 and 100 lb.	250
1	Desk	200
1	Stand	25
1	Water cooler	90
2	Chairs @ 35 lb.	70
3	Persons @ 150 lb.	450
	Total	15,860

Total floor area, 450 sq.ft.
Load per sq.ft., 35.2 lb.

Fig. 3—Office of Electric Company

Summary of Loads.

		Lbs.
	Floor covering, linoleum	488
3	Flat top desks @ 400 lb.	1,200
8	Chairs, 3 swivel @ 35 lb., 5 arm @ 25 lb.	230
2	Bookcases @ 440 lb.	880
4	File cases @ 273 lb.	1,092
2	Stands @ 25 lb.	50
1	Hat tree @ 18 lb., cuspidors and baskets, 30 lb.	48
7	Persons @ 150 lb.	1,050
1	Water cooler	90
	Total	5,128

Total floor area, 325 sq.ft.
Load per sq.ft., 15.5 lb.

Among the heaviest occupancies found is the stack room of a large law library. The entire floor area is covered with rows of steel stacks placed back to back with 32-in. aisles between rows, and extending from floor to ceiling, the story height being 11 ft. 7 in. There is a main aisle 4 ft. wide crossing the middle of the room at right angles to the stack rows. The total weight was taken as found and consisted of the following:

	Lb.
556 shelves of books, 75 lb.	41,700
114 empty shelves, 25 lb.	2,850
Books on floor	500
7 ladders	100
2 persons, 150 lb.	300
Total	45,450

Area, 588 square feet;
Load per square foot, 77.3 lb.

It is evident that if the possibility of all shelves being filled should be considered, the average loading would be increased to 87 lb. per square foot.

Safes—Examination of all the floor sketches shows but eight articles of furniture (safes) over 2,000 lb. in weight. A number of sectional filing cases and bookfound lighter next the outside walls. Single-row filing cases, cabinets, safes, bookcases and bins are usually located against blank interior walls. Whether by accident or otherwise, the heavier loads were not found where partitions cut up the floor space into small rooms, indicating that allowance may not be necessary for both removable partitions and heavy floor loads.

Combination of Loadings—Several instances were found where two adjacent floor bays supported average loads of 25 lb. or more, but in no case were two adjacent bays in excess of an average of 40 lb. per square foot.

There are but two or three instances in the floor plans discussed where three offices or store rooms meet at the same column and it is probable that this condition will be found but rarely in buildings designed for a sufficiency of light and ventilation. In view of this and of the surprisingly light average floor loads discovered, it becomes an interesting question whether in a building of this type further reductions in loads assumed for column design could be made with safety. The building was designed for a live load of 100 lb. per square foot on the first floor and 75 lb. on all others.

Cincinnati Weighings—A less exhaustive but nevertheless interesting investigation of office floor loading was recently made for the committee by Capt. M. W. McIntyre, manager of the Union Central Life Insurance Co. building, Cincinnati. This study included several large sections of different stories devoted to clerical and filing purposes. Each individual piece of furniture was not weighed, but the average weight of representative articles was carefully ascertained and this result applied to furnishings of four floors.

All files, desks, etc., were considered as being 100 per

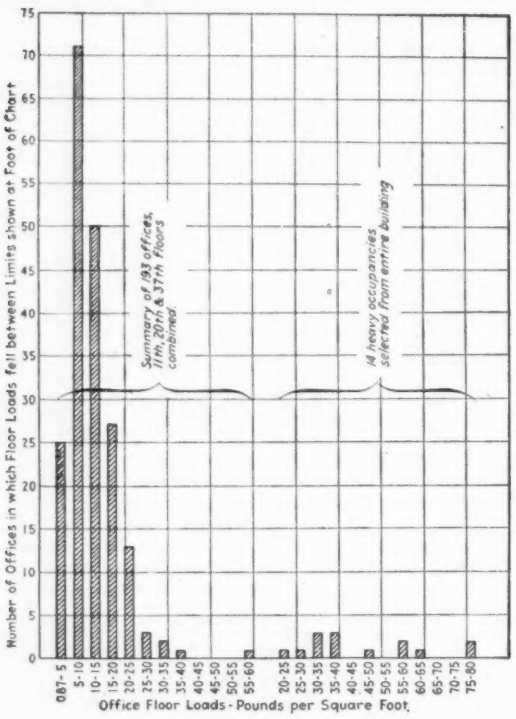


FIG. 4—FREQUENCY OF FLOOR LOADS, EQUITABLE BLDG.

cent full or furnished with all necessary accessories. Following are the results of Capt. McIntyre's investigations:

	Area, Square Feet	No. Pieces of Furniture	Total Weight Lb.	Weight of Furniture Per Sq.Ft. Lb.
Section A	10,339	635	104,478	10.05
Section B	9,303	637	27,085	2.91
Section C	7,348	273	36,306	4.92
Section D	10,339	702	121,388	11.74
Average	9,332	561.5	72,314	7.405

Weight of employees, computed at the rate of 150 lb. each, added from 0.9 to 1.75 lb. per square foot of floor area. Seven individual offices similarly surveyed showed an average weight of furniture of 7.66 lb. per square foot. This building incidentally was designed to carry a live load of 100 lb. per square foot on basement and first floor, 75 lb. on stairways and corridors, and 50 lb. on other floors.

Insurance Office—The committee has investigated the live loads in a reference room of a New York insurance company, equipped with heavy steel filing cases for large Sanborn insurance map books. This was considered to represent unusually heavy occupancy. The cases were placed back to back and occupied a floor space approximately 5 ft. x 22 ft. and were 55 in. high. It was found that the case with its aisles for access occupied a space of 247 sq.ft. and weighed with contents 10,620 lb. Observation showed it liable to use by no more than 12 men simultaneously. The total load thus occasioned amounted to 50.3 lb. per square foot.

Boston Studies—C. H. Blackall, a prominent architect of Boston, Mass., and Arthur G. Everett, of the Boston Building Department, published in the *American Architect and Building News* for April 15, 1893, the results of their investigation of three prominent office buildings of that city. The buildings were examined very carefully and copious notes taken of room dimensions, occupancy and details of contents. Average weights were assumed, based on averages for the various articles of furniture. The human occupancy was taken as the greatest known to have occurred in each of the offices investigated. The nature of occupancy was sufficiently diverse to be representative. Following is a résumé of the results obtained:

Building	No. of Offices	Total Area, Sq.Ft.	Total Weight, Lb.	Weight Per Sq.Ft. Lb.
Rogers Bldg.	41	18,127	294,984 lb.	16.8
Ames Bldg.	70	32,151	544,419 lb.	15.6
Adams Bldg.	99	26,183	425,109 lb.	16.7
Average				16.3

The ten heaviest loadings in each building averaged 25.9, 29.8 and 29.0 lb. per square foot respectively. The highest load found was 40.2 lb. per square foot. In only 12.4 per cent of the offices was the floor load in excess of 25 lb. per square foot, and in only 26 per cent did it exceed 20 lb.

Mr. Blackall recently conducted a similar investigation of live-loads in the Little Building, Boston, which is reported in the *American Architect and Architectural Review*, Jan. 3, 1923. Sixty-four offices were surveyed, the results indicating live-loads even less than those discovered in his earlier investigations. The maximum floor load was 14.7 lb. per square foot, and but four offices had loadings over 10 lb. per square foot. The minimum loading discovered was 1.3 lb.

A full interpretation of the data described discloses many significant facts which space does not permit of presenting here. A detailed report on floor loads in office buildings and other occupancies will be prepared by the committee as soon as sufficient information is obtained, and recommendations for minimum floor load requirements will be made.

Mr. Blackall's data of 1893 were the only important source of information on this subject until the investigations recently completed. A few isolated observations on school floor loads have been published, and the Building Code Committee has been able to obtain from private sources some additional information on other occupancies. The total is lamentably small, however, and all who can and are willing to supply reliable information of this sort are strongly urged to report it to the committee's office at the Department of Commerce, Washington.

Cost of Seal Coat on Wood Block

Through error the cost of placing a bituminous seal coat on wood block paving as described by James McElroy in *Engineering News-Record*, March 22, 1923, p. 531, was given as 76c. per square yard. The figure should be 7.6c. About 13,000 sq.yd. were sealed at this cost.

Ten-Year Test Shows Pavement Wear and Repair

Traffic Tonnage of Street Increases Threefold—Areas Repaired from 3 to 150 Per Cent—Openings Affect Condition

By R. A. MacGregor
Assistant Engineer, Department of Public Works, Manhattan Borough, New York City

A NUMBER of sections of test pavements were laid on Second Ave., from Houston St. to 23rd St., Borough of Manhattan, New York City, in 1912 and 1913. Sheet asphalt, both manufactured and rock, asphalt blocks of manufactured and rock asphalt, Medina sandstone, wood blocks and granite blocks were all represented.

Generally, the length of each kind of pavement was two blocks with one or two intersections, though the variations of a kind were less than a block in some cases. Second Ave. was chosen as the traffic was practically uniform over the length repaved; also, the amount of traffic was heavy enough, both in amount and in individual truck weights, to give results in a reasonable time.

Traffic Conditions—In 1911 the traffic varied from 59 tons per foot of width to 91 tons, an average of 72 tons, with about 90 per cent of it on iron tires. In 1916 the traffic was from 144 to 188 tons per foot of width with an average of 167 tons and about 59 per cent on iron tires. Since 1916 no traffic count has been made on these particular blocks, but a count on this avenue farther north shows an increase in tonnage of 29 per cent, making a probable average today of about 220 tons per foot width per day of 10 hours. All these traffic counts were made from 8 a.m. to 6 p.m.

A double-track street railway extends the full length and this area was paved with asphalt or with the same kind of pavement as the side road. The number of tons per foot width is calculated on the full width of the roadway, viz., 60 ft., but owing to the comparatively light street car traffic, this does not materially affect the weight per foot of width. However, considering standing vehicles and street cars, the traffic lane next to car tracks probably carries 50 per cent more than the average.

Kinds of Pavement—The first three blocks were laid with asphalt blocks; then two blocks of Medina sandstone, 3½-in. cubes and 5-in. deep blocks; two blocks of short-leaf pine; two blocks of sheet asphalt, open binder; two blocks of rock asphalt blocks; two blocks of asphalt, close binder; two blocks of long-leaf pine; two block of asphalt blocks; two blocks of short-leaf pine; two blocks of rock asphalt sheet, and two blocks of granite, with portland cement joints.

The asphalt blocks of manufactured asphalt were made and laid in compliance with the standard specifications of 1911, which permitted considerable variation in grading of aggregate and in penetration, etc., of the asphaltic cement. Actually over 12 or 13 different variations of penetration and ductility of asphaltic cement were used, but without any outstanding improvement over the blocks laid prior to this test.

The rock asphalt blocks were specified to be of material from the mines at Ragusa, Sicily, as was the rock sheet asphalt. The rock asphalt blocks and the rock sheet asphalt were only 2½ in. thick, while the ordinary asphalt blocks and sheet asphalt were 3 in. thick.

The wood blocks were of long-leaf and short-leaf pine, both kinds treated with three kinds of oil, heavy and light creosote oil and water gas tar and with 16 lb. and 20 lb. of oil per cubic foot, making 12 variations in all. A small area in one intersection was laid with Australian tallow wood, a hard wood much like white oak. It was untreated, but had a color like very old white oak. The blocks were about the same size as the pine blocks, and have been entirely replaced.

The granite section was laid with standard blocks 5 in. deep on a 1-in. sand cushion. The joints were filled with a portland cement grout.

TABLE SHOWING PERCENTAGE OF AREA REPAIRED ON SECOND AVE. TEST PAVEMENTS

	Kind of Pavement	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
Houston St. to 3rd St.	Asphalt Block	0.1	1.7	5.7	3.1	28.2	23.8	12.2	24.9	11.0	110.7
3rd St. to 4th St.	Medina Cubes	2.2	9.2	6.6	....	....	....	....	....	....	....
3rd St. to 4th St., west side	Medina Cubes	....	....	....	9.2	10.2	3.8	41.9	58.6	....	141.7
3rd St. to 4th St., east side	Durax	Laid	Dec.	1915	0	0	2.7	0	5.4	0	8.1
3rd St. to 4th St., west side	Asphalt Conc.	Laid	Oct.	1921	....	....	....	....	....	0	....
4th St. to 5th St.	Medina Large	....	6.6	3.0	4.7	4.7	25.8	5.2	6.5	2.4	58.9
4th St. to 5th St.	White Oak Bl.	Laid	1922	....	....	....	....	....	....	....	....
5th St. to 7th St.	Short-Leaf Pine	0	0	0	0	0	0.8	0	0	0.1	0.9
7th St. to 9th St.	Sh. Asph. Open	0	0	6.0	4.0	4.4	9.6	1.2	2.4	7.6	35.2
9th St. to 11th St.	R. Asph. Bl.	0	3.0	9.0	18.4	37.3	15.6	23.0	31.5	11.4	149.2
11th St. to 13th St.	Sh. Asph. Close	0	0.1	4.0	0.4	3.1	4.5	0.4	3.4	1.7	17.6
13th St. to 15th St.	Long Leaf Pine	0.1	0	0	0	0.1	0.2	0	0.6	2.0	3.0
15th St. to 17th St.	Asph. Bl.	13.0	6.0	19.0	17.3	35.7	29.1	5.0	32.5	6.6	164.2
17th St. 19th St.	Short-Leaf Pine	0.5	0	0	0.4	0	0.5	0.2	0.3	1.5	3.4
19th St. to 21st St.	Rock Sh. Asph.	16.3	15.2	16.0	20.9	29.8	12.9	(Entirely resurfaced in 1919)			111.1 to 1919
21st to 23rd St.	Gran. Bl.	1.8	0	8.0	0.7	0	0	0	0	0	10.5

The 1915 annual report shows the condition of the various pavements in December, 1915, three years after completion.

In the spring of 1921 a careful examination of the wood block pavements was made by the writer and some other paving engineers. These engineers found no material difference in the kinds of wood, except that the long-leaf pine showed slightly less wear than the short-leaf pine and that the water gas treated block showed up at least as well as any and perhaps a little better than the other oils. The location of the various oils and treatments was not known to these engineers until after inspection.

An examination was made in October, 1922, by the writer and the following notes were made:

Asphalt Block (Houston St. to 3rd St.)—The surface is in fair condition, though wavy. Deformation of blocks is common. One measured 11 in. wide and 12 in. long, many 7 in. wide and 12 in. long. The original size was 5 in. wide and 12 in. long. Courses are bowed from 18 to 20 in. in 10 ft. This deformation proves, in the writer's opinion, the want of uniformity in the blocks, though the method of manufacture would seem to insure it.

Durax (3rd St. to 4th St.)—This shows some wear at the joints in the intersection of 3rd St. under the cross traffic,

but the rest of the area shows practically no wear, the blocks are smooth and the joint filler flush with the surface.

(A new pavement of white oak blocks laid 1922, from 4th St. to 5th St.)

Short-Leaf Wood Blocks (5th St. to 7th St.)—The surface is practically perfect; 6 or 7 blocks were found in the light oil section, showing decay in one end for 1 to 2 in.

Sheet Asphalt—Open Binder (7th St. to 9th St.)—Surface is very wavy all over; waves short and about ¾ in. deep; general condition is fair.

Rock Asphalt Blocks (9th St. to 11th St.)—No joints can be seen and entire surface must have been covered with sheet asphalt patches.

Sheet Asphalt—Close Binder (11th St. to 13th St.)—The surface is much better than the open binder area, with about one-third as many waves and these ½ in. or less in depth.

Long-Leaf Pine Blocks (13th St. to 15th St.)—The surface is practically perfect; no decayed blocks were found.

Asphalt Blocks (15th St. to 17th St.)—The surface is very wavy; courses are bowed 2½ to 3 ft. in 10 ft., with hollows 1 to 1½ in. in depth.

Short-Leaf Pine Blocks (17 St. to 19th St.)—The surface is practically perfect; no decayed blocks were found.

Rock Sheet Asphalt (19th St. to 21st St.)—This has been entirely resurfaced by the burner method.

Granite Blocks with Cement Grout (21st to 23rd St.)—The cement joints are all about ½ in. below the surface and about one-fifth of the area has been repoured with asphalt filler. The blocks have worn smooth and the surface is very good.

The accompanying table gives the percentage of repair on each test area.

These test pavements prove the wonderful wearing qualities of wood blocks if the pavement is not damaged and weakened by cuts. About 5 per cent of the areas between 5th St. and 7th St. and between 13th St. and 15th St. was disturbed by cuts and about 10 per cent between 17th St. and 19th St.

While the rock asphalt pavements in this test have given poor results, many other rock asphalt pavements throughout the borough have given excellent wear, most of them having been laid between 1897 and 1900.

The comparison of close and open binder is decidedly in favor of the close binder, repairs being just half and the surface now much better.

Conditions on this street have been such as to give practical uniformity throughout as to cuts and traffic and these test pavements afford a good object lesson.

Municipal Leagues and the Engineer

After 10 years' existence the membership of the League of Minnesota Municipalities has grown to 200, with full-time officials and field agents working jointly with the Municipal Reference Bureau. It supports a magazine and has 16 committees on civic problems. What the league does for the engineer was stated by Carlos W. del Plaine recently before the Minnesota Surveyors and Engineers Society:

Wherever a municipality is an active member of the league, there the work of the engineer is made easier. The reason for this is that no city or village can be an active member of the league without realizing the necessity of efficiency in government. And no municipal government is efficient unless it has a competent engineer supervising the work done. The league gives engineering advice to its members but does not do any engineering work whatsoever. Instead it urges that competent engineers be employed and emphasizes the fact that real economy is effected when good engineers are employed at reasonable prices rather than any kind of an engineer merely because he is low-priced.

Refuse Incinerators Advised for City of Boston

ABANDONMENT of garbage reduction at Boston, Mass., and the building of eight incinerators of the type being promoted by the Balmer Corporation, New York City, together with the substitution of the contract system of garbage and refuse collection for the 60 per cent of the material now being collected by the city direct, are the chief recommendations of a report recently made to the city authorities by Colonel George A. Johnson, consulting engineer, New York City. It is assumed that Coleman Brothers Co., the present contractors for garbage disposal by reduction, would willingly terminate the contract piecemeal as the proposed incinerators were completed. Utilization of heat from the incinerators for the production of electric current for sale by the city is proposed in the report. The incinerators would be similar to those at Montevideo, Uruguay, and the plant contracted for recently by the City of Charlestown, W. Va.

Colonel Johnson's summary of estimates for his plan, slightly rearranged but with no change otherwise, is given in the accompanying table. It will be noted that by assuming a heavy decrease in the cost of collection and a considerable revenue from heat and clinker utilization, and by assuming also that the present contractor would cancel the unexpired portion of his ten-year contract in force July 1, 1922, Colonel Johnson figures a "potential annual saving" of $543,506 by means of the changes which he proposes, or about one-third of the total present annual cost of garbage, ashes and refuse disposal.

Colonel Johnson's report, without the numerous and voluminous appendixes, is printed in the Boston *City Record* for March 3.

ESTIMATED POSSIBLE SAVINGS ON GARBAGE, ASHES AND REFUSE COLLECTION AT BOSTON, MASS., AS GIVEN IN REPORT BY COL. GEORGE A. JOHNSON

Total combined refuse, 482,147 tons annually, of which the garbage amounts to 78,609 tons; ashes, 371,278 tons; rubbish, 32,260 tons.

Total cost of collection and transport to destructor stations of 482,147 tons of combined refuse	$864,390
Annual saving over present collection costs	461,415
Total cost of building and completely equipping the eight destructor stations, having a total daily rated capacity of 1,950 tons, or 711,750 tons annually, which is 48 per cent in excess of the total present annual production of combined refuse	2,255,000
Annual cost of operation and maintenance of the eight destructor stations, including a 10 per cent fixed charge on the capital investment to cover interest, depreciation and sinking fund	640,930
Total cost of building auxiliary power development plants at [6 of the 8] stations	1,023,695
Annual cost of operation and maintenance of the 6 auxiliary power development plants, including a fixed charge of 10 per cent on the capital investment to cover interest, depreciation and sinking fund	222,869
Combined cost of building the eight destructor stations and the 6 auxiliary power development plants	3,828,695
Combined annual cost of operation and maintenance of 8 destructor stations and the 6 auxiliary power stations, including fixed charges to cover interest on the capital investment, sinking fund, repairs and replacements	863,799
Annual revenue derivable from electric current produced at the 6 auxiliary power stations, based on present amounts of refuse, and with current valued at 1c. per kw.-hr.	477,350
Annual revenue from clinker from 8 stations, 167,820 tons at $0.30 per ton	50,346
Revenue derivable from marketable electric current and clinker produced	527,696
Net total cost to the city for the incineration of 482,147 tons of combined refuse annually	336,103
Total annual net cost of collection, delivery and incineration (made up of net cost of incineration, $336,103, plus $864,390 for cost of collection and transport to destructor stations of 482,147 tons of combined refuse)	1,200,493
Present total cost to the city for refuse collection and disposal	1,748,999
Net cost under new plan	1,200,493
Potential annual saving by adoption of the new program involving collection and incineration of the combined refuse	548,506

Railways of Russia, the Balkans and the Baltic States

Russian Problem of Long Standing—Fair Progress in the Balkans—Many Gages a Problem in the Baltic States

This is the last of three articles on the European railway situation by the London correspondent of ENGINEERING NEWS-RECORD. *The first on the general subject appeared in the issue of Mar. 8, and the second on conditions in France, Germany and Poland in the issue of Mar. 15.*

THE present deplorable state of the Russian railways is due not entirely to the Soviet revolution but also to the lack of railway development in the policies of Czarist governments. The lack of suitable railways was felt long before the war when there were insufficient trains to carry the ordinary passengers in addition to the products of industry. True, certain lines appeared well organized and service on these routes was good; on the lines running from east Germany to Petrograd and Moscow, for example. But here the influence of other countries aside from Russia was felt, because the traffic on these lines was largely international both in passengers and freight. Where Russia alone had to be served the systems were deplorably organized.

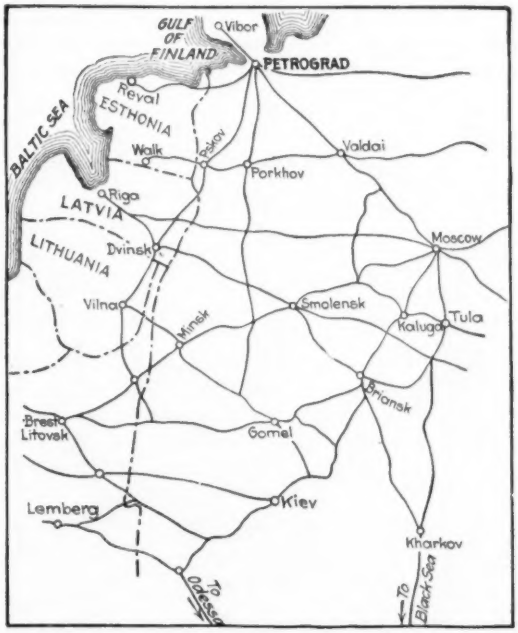
The need Russia felt then has been made even greater today owing to the lack of organization of any type throughout the country. The lines are laid out on the main economic routes, and usually well-laid, but the majority of them have been uncared for for the past eight or nine years and relaying with new metal and ties has become an urgent necessity.

Physical Condition Cuts Capacity—As matters now stand the ties and track support are in so bad a condition that freight trains of only moderate weight can pass over at greatly reduced speeds, or on some sections train services are impossible. In other cases the metal must be entirely renewed and a heavier type laid before any sort of traffic can pass. Bridges also are lacking and those destroyed during the revolution have only been rebuilt in part. A few have been rebuilt on a permanent basis on one or two of the main routes, but on the whole it may be said that 80 per cent of the railway bridges need renewal. The same applies to other equipment such as depots and repair sheds. That part of this very essential equipment which was not totally destroyed was rifled. Up to now very little has been done to replace this equipment, while the railway signalling and telegraphic services are conspicuous by their absence.

Of rolling stock there is very little of serviceable value. At present the number of locomotives available for haulage is under 10,000 while an additional 12,000 are rusting in the yards for lack of major or minor repairs. The number of passenger coaches which will hold the track average about two per locomotive in addition to one per locomotive awaiting rebuilding or repairs. The freight cars available for transport are about twenty per locomotive with another ten held up for repair. In some of the larger cities workers are engaged in repairs to the railway stock but this work is necessarily slow because the machine tools and other equipment have been in use since about 1912.

Naturally, on account of the huge areas to be served by transport it is impossible to tide over the present period by employing road services; in fact the roads that do exist are just about in as sad a condition as the railways, so no palliative can be looked for in this direction.

Concentrate on Food Carriers—The Soviet transit authorities are endeavoring to remedy the existing state of affairs by concentrating their efforts on the reorganization of those lines which are essential to the transport of foodstuffs. There are various long lines reaching to the food-growing districts and these before the war carried the bulk of the Russian traffic. Here the present track is to be renewed where necessary and heavier rails laid to carry the heavier freight trains which will be run when the agricultural industry has again got into its stride. This applies particularly to southeast Russia, where it is hoped to develop grain growing to a large extent, and also to the service between Petrograd, Moscow and the Black Sea ports. Unfortunately for railway construction, Russia is not a highly industrialized country like Britain, for example, and that material which can be constructed in Russia must be transported over very long distances to the point of use. Again, a large part of the new material must be purchased outside Russia when finances or guarantees are available, and when some sort of transport from the Russian ports to the shops and damaged systems can be organized.



RUSSIA'S PRINCIPAL RAILWAY LINES

Russia is enormously handicapped in the work of railway construction by the fact that her system was quite inadequate before any war or revolution damage was done. Her system was under very irregular control and lines were laid either for military purposes or as the result of the influence of some industrial magnate.

The lack of skilled railway personnel also is felt. The majority of qualified engineers, belonging as they did to the bourgeoisie, were either imprisoned and executed or driven from the country. Russia, before any sort of railway system can exist in her country,

has to attract and safeguard foreign interests as well as skilled technical brains.

The Balkan Railways—A railway map of the Balkan countries, Jugoslavia, Albania, Bulgaria and Greece, will show a distinct scarcity of railway lines. Three main lines traverse Jugoslavian territory, two Bulgarian and one Greek. Aside from the connections between Budapest and Trieste and Fiume, and the projected line from Belgrade to Cattaro, there seem to be no lines impinging on the northern side of the Adriatic. Despite this the Balkans are among the most important of the railway areas in Europe. Direct rail communication between western Europe and the East must pass right through the Balkan countries. The business man from France or Germany to Constantinople must pass through Belgrade, the capital of Jugoslavia, and this city was the center of a vast continental traffic including express routes from France to Russia, Poland to Greece, London to India and Russia to the Adriatic.

This favorite fighting ground of Europe has had a large part of its system destroyed and the remainder

RAILWAYS IN THE BALKAN STATES

completely disorganized. Serbia, now part of Jugoslavia, suffered early in the war, and the entire system was demolished, railway track and bridges being blown up. That part of Austria-Hungary which is now under the Jugoslavian monarchy underwent some damage to the railway system, but this was practically confined to the rolling stock, the permanent way and bridges being little interfered with. The Bulgarian system was kept in fairly good condition by German engineers but since the war there has been no organization at all, and the future railway system must be reconstructed almost from the beginning as far as personnel is concerned. The locomotives and rolling stock especially are among the most primitive in Europe.

Balkans Make Progress—The Balkans have, however, not been slow to reconstruct. The Serbian or other Jugoslavian lines were in a condition to carry freight within a year of the armistice, though locomotives and rolling stock are still very short of that country's requirements. Owing to the fact that Jugoslavia is a new state, created at Versailles, immense difficulties have been in the way of reorganization, and materials, money and skilled labor are lacking. However, this state has been able to raise sufficient money and find enough men to put the lines in order so that heavy traffic can be carried at a reasonable speed on all the lines of the pre-war system. In addition new lines are to be built linking Belgrade, the capital, with Cattaro, the state's new port on the Adriatic.

It is in rolling stock, however, that Jugoslavia's chief need lies. For normal passenger and freight operation this new state requires upwards of 2,000 locomotives and 60,000 cars and coaches. She now possesses about 60 per cent of each requirement, and of these half are constantly under repair, owing to the fact that the best of the rolling stock was captured during the war and taken into foreign territory. In addition to this handicap, the railway repair shops and depots now within Jugoslavian territory were destroyed during the war. This necessitated repairs to locomotives and cars being done in foreign shops, and labor troubles in the shops of the repairing concerns have proved a serious hindrance to the normal operation of the Jugoslavian railway system. The bulk of this work was undertaken by Austria where the currency was favorable. The rolling stock situation has been partially improved by taking reparations from Germany in the form of locomotives. Delivery of this material has been on the whole good and has enabled Jugoslavia to go ahead with the reorganization of traffic.

Shortage of Rolling Stock—The other systems in the Balkans have suffered less from permanent way destruction but quite as much from the wearing out of rail stock. Bulgaria now is very short of locomotives and has placed contracts in German shops for the construction of new stock. The rolling stock position in Greece is especially serious and she has practically no equipment in really first-class condition. On the other hand, her system was practically untouched by the war. The Greek railways were never of very much account, however, so that her shortages affect the rest of Europe very much less than the deficiencies in Jugoslavia and Bulgaria.

The Balkans as a whole are suffering from the lack of skilled railway workers and much of the present labor has practically no experience of either rail maintenance or operation. This is due not only to war losses but the upheaval caused by the division of Austria-Hungary and the various industrial and political disturbances which are notoriously inseparable from southeast Europe. The eight-hour day is also a contributory factor to unrest and inefficiency. More workers have had to be taken on for less work and this, combined with a greatly increased wages bill, has driven operating costs to an unprecedented height.

Owing to the shifting of political boundaries Jugoslavia especially finds herself unable to cope with the present traffic demands. To deal with existing and potential traffic the existing routes are to be reinforced by one or more lines, depots are to be doubled in number and in size and pre-war repair sheds rebuilt and their number increased. The Balkan area is not short of skilled executives but they are rapidly coming to the realization that forces of specialized workers are essential to successful railway operation. Accordingly the state is taking this problem in hand and making specialized instruction a part of the reorganization scheme.

The difficulty now is lack of adequate finances, in spite of certain sums raised abroad, in America for example, and an item on next year's budget of some million dollars or so.

The Baltic States—One of the great problems confronting the three new states, Esthonia, Latvia and Lithuania, is the reorganization of the railway system. These three states are on the east of the Baltic and were formerly part of the Russian Empire. The result of this was that all the railway systems in Russia turned about the two chief cities, Petrograd (then St. Petersburg) and Moscow. Consequently, when these three states were created they found themselves saddled, not with complete railway systems, rolling stock and staffs, but outlying sections of a former system with rolling stock and staff grouped round the Russian capital. Latvia is the best off of these three because railways had been constructed to serve the port of Riga. All three republics suffer not only from shortage of the lines but also from the fact that they all run straight from Poland through to Russia.

The Gage Problem—Another handicap in the situation is that these three new states have probably the largest assortment of gages that it would be possible to find anywhere. Latvia has both the standard gage (4 ft. 8½ in.) and the Russian broad gage. The other two states have lines of both these gages in addition to one or two meter-gage lines, and also side lines of apparently any gage that it pleased the engineer to lay down. This complexity of gages means a large amount of complete rebuilding before through traffic can be run, on all except one or two lines.

Lithuania, the most southern of these states, has a total railway mileage of 3,200 km., rather more than half being broad gage, the rest being made up of the standard and narrow gages. Most of this system has fallen temporarily into disuse because, during the war, first the Russians seized their locomotives and rolling stock, then the Germans took a hand—between the two, Lithuania was left with next to nothing. She actually possesses now about 10 broad-gage and 60 narrow-gage locomotives, about 3,000 freight cars, and 300 passenger coaches; hardly sufficient stock to make the systems pay. Before the war this section of the Russian railways yielded a net profit of ten million rubles, it is now less than a hundredth of that sum.

Situation in Esthonia—Esthonia is slightly better off, due to the fact that her proximity to Petrograd has given her rather a larger network of lines, and also because the important port of Reval is in her territory. Most of this system is built on the Russian broad gage (5-ft.) while subsequent or less important lines have been made narrower. In all, this republic owns 650 km. of state-owned narrow-gage line and 300 km. of privately-owned narrow-gage. Owing to the flat nature of the country railway construction is easy and no natural obstacles are found. As a matter of fact the grades in Esthonia nowhere exceed 0.01 per cent and all curves have a radius exceeding 1,300 ft. Esthonia is fortunate in that the majority of her lines were constructed by Russian engineers, whose construction code was very strict. So far as railway stock is concerned this state possesses 200 locomotives, 450 passenger coaches and about 5,000 freight cars—inadequate for efficient transport in normal times, but quite good enough to cope with present traffic needs.

Except at the important centers of Riga and Reval the repair shops and depots are but poorly equipped. The greater proportion of the repairs in pre-war times were executed in Russia, while the well-equipped repair shops existing in the areas under discussion were stripped either during the war or during the revolution.

The greatest need of these Baltic states is the service of skilled technical personnel. The engineers formerly were Russians, servants of the Czarist government, and now either dead or living in foreign countries. The same applies to the skilled railway workmen. Most of these were withdrawn into the Russian army and, after the revolution, put to work on Russian railways. In these circumstances the three republics find themselves compelled to train an entirely new staff, both of skilled engineers and laborers.

BALTIC RAIL LINES NOT INDEPENDENT SYSTEMS

Fewer Marine Borers in San Francisco Bay in 1922

MARINE borers in San Francisco Bay were less prevalent in 1922 than in 1921 due to fewer available breeding places and a shorter season because of the higher percentage of fresh water and also colder temperatures. Examinations made by the San Francisco Bay Piling Committee, as reported at a recent meeting of the American Wood Preservers' Association, indicate that the ravages of *"Teredo navalis"* may be much curtailed if "marine sanitation" is persisted in. Such "sanitation" according to Charles A. Kofoid and Robert C. Miller who have charge of the biological section of the committee, consists in the removal of untreated timbers which might serve as breeding places and a general "policing up" to remove from the shores of the bay driftwood, old hulks, etc., which might provide foci of infection for commercial structures.

Practically without exception, says the report, replacements have been made with treated piles and engineers have shown a disposition to remove old piling before driving the new, rather than following the careless practice of re-driving alongside of the old piles, leaving the untreated stumps to harbor a multitude of borers. Attacks by *Teredo* on untreated timbers, which reached a climax in 1919 and 1920, were considerably less in 1921 and had still further declined in 1922.

Eighteen of 69 Large Cities on 1922 Typhoid Honor Roll

No Typhoid Deaths in Providence, New Bedford and Yonkers—Nashville Has Highest and Trenton Next to Highest Rate

OF THE 69 cities in the United States with a population of 100,000 and over, typhoid statistics for 1922 show 18 cities on the honor roll with from 0 to 2 deaths from typhoid per 100,000; 29 cities fall in the next class with rates from 2.1 to 5; 17 rank from 5.1 to 9.2; and 5 have typhoid rates of from 10.2 to 16.2. The figures for each of the 69 cities are shown in Table I, which is one of ten tables published in the *Journal* of the American Medical Association for March 10, 1923, as part of its eleventh annual survey of typhoid fever in the larger cities of the United States. Table II, from the same source, presents mass figures for the years 1910 to 1922 inclusive, covering 57 cities as against the 69 for the year 1922 alone. Table II shows that although the population of these 57 cities increased from 21 to 27 millions from 1910 to 1922, the total typhoid deaths decreased from 4,114 to 851 and the typhoid death rate per 100,000 from 19.59 to 3.15. With the exception of slight increases in 1913 and 1921 as compared with the immediately preceding year, the decline has been continuous.

Part of the *Journal's* comment on the result of its survey are as follows:

The slight check that occurred in 1921 to the almost steady decline of twelve years has been followed, as we predicted last year, by a further decrease. Compared with 1921, 46 cities showed a diminished and only 23 an increased typhoid rate. It does not seem over sanguine, knowing what we do of modes of typhoid dissemination, to believe that city typhoid rates will decline still further. We are certainly not manufacturing typhoid carriers in the United States as abundantly as we were fifteen years ago.

* * * * *

Trenton affords the highest typhoid rate in northern cities, and finds itself in the third rank, having for its only companions four southern cities with a large negro population, and surrounded by rural areas in which typhoid is far more prevalent than in the neighborhood of Trenton. Trenton and Reading might perhaps profit by an anti-typhoid campaign. Is there any reason why these cities should have consistently higher typhoid rates than Paterson and Scranton?

As Table I shows, Reading has the highest rate of the cities in what the *Journal* calls the second rank, having had a typhoid death rate in 1922 of 9.2 per 100,000. Paterson fell just short of getting on the honor roll, its rate having been 2.1. The Scranton rate of 1.4 was still lower.

The Trenton typhoid rate in 1921 was only 8.9 and the average for the years 1916-20 still lower—8.6—while for 1911-15 the average was 22.3. Nashville shows steady improvement: 16.2 for 1922 against 20.4 in 1920, 20.7 for the five years 1916-20; 40.2 for 1911-15 and for 1906-10 the very high average of 61.2 typhoid deaths.

TABLE I—DEATH RATES FROM TYPHOID IN 1922

Honor Roll (from 0.0 to 2.0)—18 Cities			
New Bedford	0.0	Scranton	1.4
Providence	0.0	Springfield	1.4
Yonkers	0.0	DesMoines	1.5
Bridgeport	0.6	Jersey City	1.6
Grand Rapids	0.6	Syracuse	1.6
Cambridge	0.9	Albany	1.7
Chicago	1.0	Akron	1.9
Columbus	1.1	Minneapolis	1.9
Boston	1.4	St. Paul	2.0
First Rank (from 2.0 to 5.0)—29 Cities			
Paterson	2.1	Fall River	3.3
Cleveland	2.2	Portland	3.3
New York	2.2	Buffalo	3.5
San Francisco	2.2	Dayton	3.7
Milwaukee	2.5	Los Angeles	3.7
Rochester	2.5	Toledo	3.8
Lowell	2.6	Baltimore	4.0
Newark	2.7	Tacoma	4.0
Philadelphia	2.7	St. Louis	4.2
Hartford	2.8	Omaha	4.4
Seattle	2.8	Richmond	4.4
Cincinnati	2.9	Pittsburgh	4.6
Oakland	3.0	Kansas City, Mo.	4.9
Worcester	3.1	Detroit	5.0
Salt Lake City	3.2		
Second Rank (from 5.0 to 10.0)—17 Cities			
Wilmington, Del.	5.1	Youngstown	6.2
Washington, D. C.	5.2	Norfolk	6.4
Indianapolis	5.4	Kansas City, Kan.	7.0
San Antonio	5.6	Houston	7.3
Camden	5.7	Fort Worth	7.8
Spokane	5.7	Louisville	8.0
Dallas	5.8	Memphis	8.9
New Haven	5.8	Reading	9.2
Denver	5.9		
Third Rank (from 10 to 20)—5 Cities			
New Orleans	10.2	Trenton	15.9
Atlanta	10.9	Nashville	16.2
Birmingham	12.5		

TABLE II—TOTAL AVERAGE TYPHOID DEATH RATE (1910-1921)

	Total Population (57 Cities) Estimated by the U. S. Census Bureau Methods	Typhoid Deaths	Typhoid Death Rate Per 100,000
1910	20,996,035	4,114	19.59
1911	21,545,014	3,391	15.74
1912	22,093,993	2,775	12.56
1913	22,642,972	2,892	12.77
1914	23,191,951	2,408	10.38
1915	23,740,930	2,068	8.71
1916	24,205,359	1,842	7.61
1917	24,740,068	1,647	6.65
1918	24,971,278	1,557	6.23
1919	25,526,186	987	3.87
1920	26,154,013	921	3.52
1921	26,561,469	978	3.68
1922	26,936,843	851	3.15

Canadian Institute Committee Reports on Salaries

First Part of Classification Report, Now Before Members, Deals With Salaries—Section Relating to Fees Will Follow

PART I of the report of the committee on classification and remuneration of engineers dealing with compensation and classification for those not in consulting practice has been received by the council of the Engineering Institute of Canada and published for the information of its membership. It is anticipated that the report will be discussed in the various branches and that the branches will express their wishes with regard to its adoption by the Institute. Part II, relating to fees for special work, particularly in consulting practice, is expected by the council at an early date.

The committee was constituted in March, 1920. In its deliberations it has taken account of reports from the various branches of the Institute, from the British Columbia Technical Association, and from certain engineering societies in the United States, as well as that of Engineering Council. It has availed itself also of information published from time to time in the technical press and has considered the classification of the Dominion government engineering and allied services made under the supervision of the Civil Service Commission of Canada.

The committee considers a standardized classification as being a first essential toward any concerted effort for proper engineering compensation and has devoted much study to the formulation of an appropriate classification and scale of remuneration. With some alteration, it has adopted, as a basis for its classification, that proposed by Engineering Council, but it has dis-

carded the subdivision into professional and sub-professional service. It has also given to the college graduate, for the first year or so after graduation, less advantage over the non-graduate with experience, but has allowed a greater advantage thereafter until the higher positions are reached. The committee points out that the title attached to an engineering position need not necessarily indicate the grade that would be accorded that position in its classification. The title of "chief engineer" of a small industrial concern or municipality might in the matter of duties and qualifications correspond to a grade considerably lower than that of a chief engineer who, in a position of great importance, might have to be a man of the highest engineering ability with executive attainments. The committee accords the title of chief engineer to such positions only and considers them as outside the scope of classification.

Proposed Classification—The classification prepared by the committee contemplates eight grades as follows: Grade I, assistant chief engineer; Grade II, engineer; Grade III, senior assistant engineer; Grade IV, assistant engineer; Grade V, junior assistant engineer; Grade VI, junior; Grade VII, senior aid, and Grade VIII, junior aid.

An assistant chief engineer (Grade I) would have administrative charge of a technical organization or a main division thereof, determine general policies under limitations of law, regulation, or other fixed requirements, would have final responsibility in the preparation of reports, estimates, designs and specifications, and for the construction, maintenance or operation of engineering works, would have full charge of collection and presentation of data in valuation proceedings, or direct the most comprehensive lines of engineering research. To qualify for this grade the committee requires an appropriate training and experience of at least twelve years, of which at least four years shall have been spent on similar work in a subordinate position and at least five years in responsible charge of important work, together with fundamental training equivalent to that represented by a professional degree from a recognized institution, or additional experience of at least four years. Positions corresponding to this grade might be assistant chief engineer, city engineer, superintending engineer for a province, etc.

The engineer (Grade II) would have responsible charge of determining policies for a major subdivision of an organization, under general administrative direction and within the limits of general policies; would prepare for final executive action reports, estimates, designs, specifications and valuation studies and data, would have immediate charge of construction, maintenance or operation of engineering works of major importance, direct major lines of engineering research or furnish for executive action expert advice on engineering works, or policies. His qualifications should comprise professional practice or executive charge of work for at least eight years, of which at least three years have been spent in similar work in a subordinate position, and at least three years in responsible charge of work, fundamental training equivalent to that represented by a professional degree from a recognized school or at least four years of additional experience. Positions corresponding to this grade might be engineer, district engineer, designing engineer, etc.

The senior assistant engineer (Grade III) would, under general administrative and technical direction, have responsible charge of an intermediate division of an organization, exercise independent engineering judgment and assume responsibility in studies and computations and would have immediate charge of construction, maintenance and operation of important engineering works, or conduct or direct important lines of engineering research. Qualifications should include active professional practice or executive charge of work for at least five years, of which at least three have been spent in similar work in a subordinate position and at least one year in responsible charge of work; training equivalent to that represented by a professional degree from a school of recognized standing, or at least five years of additional experience. Positions corresponding to this grade would be senior assistant engineer, division engineer, or engineer of a department.

Assistant engineer (Grade IV) would, under specific administrative and technical direction, have responsibility for the conduct of a minor subdivision, collection and compilation of data for special items of engineering study, immediate charge of field survey projects, or of design and construction, would lay out and develop work from specifications and supervise the work of a drafting or computing force, or conduct specific tests or investigations of apparatus, materials or processes. Qualifications should include experience of at least three years, of which one year shall have been spent on similar duties in subordinate positions; fundamental training equivalent to that represented by a professional degree from a school of recognized standing, or additional experience of at least five years. Positions corresponding to this grade would be assistant engineer, estimating engineer, chief engineering draftsman, engineer on construction, etc.

The junior assistant engineer (Grade V) would, under immediate supervision, take charge of drafting squads, direct a field party on surveys or construction, direct the computation of surveys and estimates, design minor engineering works, compute data for reports or records, investigate minor details of engineering work, perform tests of apparatus, material or processes, or have charge of inspection of engineering works under construction. Qualifications should include experience of at least two years in similar duties in a subordinate position, fundamental training equivalent to that represented by a professional degree from a school of recognized standing, or an education equivalent to graduation from a high school and at least four years of additional experience. Positions corresponding to this grade would be junior assistant engineer, inspecting engineer, etc.

A junior (Grade VI) would supervise the plotting of notes and maps and be competent to use surveying, measuring and drafting instruments, take charge of parties on survey or construction work, to design details from sketches and specifications, to compute data for reports or records, to inspect or investigate minor details of engineering works, to supervise construction or repairs or to check plans, surveys, and other engineering data. Qualifications should include experience for at least one year in similar work in a subordinate position, fundamental training equivalent to that represented by a professional degree from a school of recognized standing or education equivalent to graduation from high school and at least three years of additional experience. Positions corresponding to this grade would be senior draftsman, inspector, etc.

Senior aid (Grade VII) would prepare general working drawings where design is furnished, plot notes and prepare maps, design simple structures, make computations and compile data for reports and records, prepare routine tests of apparatus or materials, run surveying instruments and adjust and care for same, compute surveys and estimates, make minor engineering computations, and inspect incidentally construction or repair work. Qualifications should include experience for at least two years in work of a nature to qualify for this grade, education equivalent to graduation from a high school, and familiarity with the use of the slide rule and of logarithmic and other simple mathematical tables. Positions corresponding to this grade would be draftsman, leveler, transitman, etc.

Junior aid (Grade VIII) would trace and letter maps and plans, make simple drawings from sketches and data, make minor calculations, run type or leveling rod, perform other miscellaneous subordinate duties in survey party and field or office as directed. Education should be equivalent to graduation from a high school. Positions would be tracer, chainman, rodman, etc.

Proposed Compensation—In arriving at a scale of remuneration the committee has taken into account the opinion of members of the Institute throughout Canada as to reasonable compensation and points out that these show a very wide range, especially in the higher grades. The variation does not appear to be a matter of location and as an illustration it cites the report of the Vancouver branch, where the scale of remuneration proposed by a committee appointed by the branch was raised from 15 to 20 per cent for the intermediate grades at a general meeting of the branch. No attempt was made to give different salary schedules for the various services, such as railroad, municipal or industrial. Duties of the same nature, the committee says, should command the same remuneration, other conditions being the same, whether the work is done in the service of a railroad, municipality, or industrial concern. The range between minimum and maximum allows latitude for the varying abilities of individuals.

The committee feels that while the rates of remuneration proposed may seem too low to many members of the Institute, it would be advisable to be moderate in the first scale; otherwise there would be danger of defeating the object for which the schedule is designed. It points out also that there would be no hope of making a schedule effective if it be made so high that many members of the profession not members of the Institute would be satisfied to accept lower salaries. The committee is of the opinion that salary ranges for the engineering positions in the Dominion government service are inadequate for the professional qualifications exacted. It recommends adjustments to give either higher salary ranges for the present specifications or reduced qualifications for the present salary ranges, if it is desired to attract and retain a staff of properly qualified engineers for government service. The following table summarizes the recommendations of the committee as to the grades, experience, and salaries:

Grade	Title	Years With Degree	Years Without Degree	Salary Range Min.	Salary Range Max.
VIII	Junior Aid	0	0	600	1,200
VII	Senior Aid	0	2	1,200	1,800
VI	Junior	1	4	1,800	2,400
V	Junior Asst. Engr.	2	6	2,400	3,300
IV	Asst. Engr.	5	8	3,300	4,200
III	Senior Asst. Engr.	5	10	4,200	5,400
II	Engineer	8	12	5,400	no limit
I	Asst. Chief Engr.	12	16	7,200	no limit

Blowout in Relaid Cast-Iron Pipe

By McKean Maffitt
Superintendent Water-Works, Wilmington, N. C.

A RECENT blowout in an 8-in. water main at Wilmington, N. C., together with a number of similar blowouts a few years ago, illustrates the results of carelessness in handling cast-iron pipe and the importance of thorough inspection of pipe when it is being handled.

In 1910 the Wilmington water-works was partly rebuilt. All of the work was done by contract under the supervision of engineers employed by the city. In the course of this work certain mains were moved from one street to another. The pipe was to be taken out of the ditch, cleaned, re-coated, inspected and tested before being relaid. There was no great care used in the handling of the pipe and the inspection and testing must have been very slack. Immediately after installation we had four blowouts from cracked pipe. In every case the tar could be seen in the cracks showing that the cracks were simply covered up with the tar coating.

In the next thirteen years we had no trouble with this pipe, but a few weeks ago there was a blowout under normal pressure conditions. The immediate cause of the blowout was a crack about 4 ft. in length, running along the longitudinal axis of the pipe with several smaller cracks radiating out from the large crack in every direction. An examination of the metal of several pieces of the broken pipe showed cracks that were full of rust, cracks that were partly in new metal and partly old metal. One of these cracks, which was visible from the inside of the pipe but not visible from the outside of the pipe, was so bold that the piece of metal showed the crushing-in of the pipe (a straight edge showed a misalignment of nearly ⅜ in.).

The marvel is that this pipe should have held the domestic and fire pressure for thirteen years without showing any sign of leakage. It also shows that a little carelessness in handling cast-iron pipe will materially injure it, though a thorough inspection should have shown the cracks present.

T.N.T. Moves Rock on Tieton Dam Project

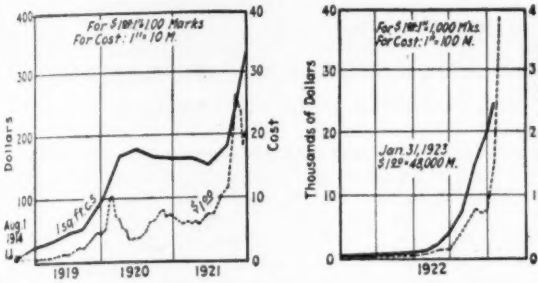
Twice in the construction of the Tieton Dam for the Yakima irrigation project in Washington, large quantities of rock have been loosened and moved by the explosion of charges of T.N.T. The first blast, fired on March 5, 1922, used five tons of the explosive and the second blast fired on Dec. 19, 1922, employed 11.4 tons of T.N.T. Both blasts were on the line of the spillway excavation and were so located that rock blown off into the canyon below would serve as part of the fill for the dam. In the first blast the explosive was loaded into three pockets, spaced 26 ft. apart, and located 74 ft. in from the surface of the bluff, measured horizontally. The central charge consisted of 1.5 tons and the two other pockets each contained 1.75 tons of explosive. This blast broke up and loosened 22,100 cu.yd. of rock, of which 13,700 cu.yd. fell into the river channel within the limits of the dam fill. In the second blast the explosive was placed in eight pockets, two containing 1.2 tons each, and the other six 1.5 tons each, all spaced about 34 ft. apart and located about 50 ft. horizontally from the face of the hillside. This blast loosened 19,000 cu.yd. The work is under the direction of F. T. Crowe, construction engineer, U. S. Reclamation Service, Rimrock, Wash.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

A Graphic View of German Economic Conditions

Sir—The two accompanying diagrams show in an impressive way the economic catastrophe that has occurred in Central Europe. The data are taken from a great number of contracts, mainly for factories and other buildings of the ribbed-slab floor type, carried out by a large reinforced-concrete firm on the German upper Rhine. For those living in a country of more or less sound economic



3-YEAR RISE IN GERMAN CONCRETE COSTS

conditions, it will be difficult to imagine what an increase of prices by hundreds of per cent in one week or less means. Calculations, disposition, right business methods are impossible of execution. The fatal curves show what is happening—a convergence towards a vertical asymptote!

Neustadt, a. d. Hdt. 3. Feb. 1923. ARN. ESCHER.

Baltimore Water Sedimentation

Sir—In my article published in your issue of Feb. 1, p. 204, "Experiments on Formation of Floc for Sedimentation," I note that while the curves in Figs. 2 and 3 are plotted correctly, the legend is reversed. It should be:

———— velocity 0.96-1.15 (solid line)
- - - - - - - - velocity 1.15-1.25 (broken line)
. . . . . velocity 1.26-1.35 (dotted line)

This incorrect presentation produces an entirely different conclusion from that expressed in the text of the article.

Baltimore, Md., Feb. 21, 1923. EDWARD S. HOPKINS, Chemist.

Treatment Conditions in Concrete Tests

Sir—With reference to the effect of integral waterproofing compounds on the strength of concrete it is important to bear in mind the difference to be expected between tests of specimens cured under ideal laboratory conditions and those cured under conditions more nearly similar to what is found on the job.

In the tests of the U. S. Bureau of Standards reported in Technologic Paper 174, comparison was made between the effects of CAL, a patented calcium oxychloride compound, on concrete specimens (6 x 12 in. cylinders) cured in damp sand, and exactly similar specimens, made at the same time, stored in the laboratory air at an average temperature of about 66° F. and an average relative humidity of 65 per cent.

The results of 28 days showed an average strength of 94.5 per cent of normal (average strength of untreated specimens) for the treated concrete stored in damp sand, and an average of 104 per cent of normal for the treated concrete stored in air.

In the same series of tests 1:3 mortar specimens stored in air showed an average strength of 28 days of 108 per cent of normal, for specimens treated with 5 per cent of the compound.

RICHARD H. CATLETT,
Hagerstown, Md., Gen. Mgr. CAL Chemical Co., Inc.
March 2, 1923.

Ton-Mile Freight Costs on Great Lakes

Sir—*Engineering News-Record*, Feb. 22, 1923, p. 364, gives a table credited to a committee of the Western Society of Engineers, showing the annual interest and maintenance cost of several waterways and the similar cost per ton-mile of freight traffic. It occurs to me that it might be of interest to your readers to compare the data given with those pertaining to the Great Lakes.

In the following table the figures appearing in your printed article are rearranged but unchanged. A slight discrepancy appears in the data on the Allegheny Waterway. Assuming the correctness of the first and second columns, the ton-mile cost in the third column should be 0.028 instead of 0.016 as printed. However, the effect of any such typographical error does not affect the totals, appreciably.

WATERWAY IMPROVEMENT COSTS

Waterway	Ton-Miles Per Year (Millions)	Total Annual Cost (Includes Annual Maintenance plus 5% of First Cost)	Cost of Improvement per 1,000 Ton-Miles per Year, Including Maintenance
Allegheny	10.2	$288,000	$16.00
Mississippi (mouth of Missouri to Cairo)	175	989,000	5.65
Warrior system	173	775,000	4.47
Monongahela	782	1,700,000	2.16
Mississippi (Vicksburg to New Orleans)	750	1,600,000	2.15
Sacramento	96	132,750	1.38
Ohio	4,220	4,600,000	1.10
Total—River waterways	6,206	10,084,750	1.62
Great Lakes system	60,420	6,309,000	0.104

The data for the Great Lakes appearing in the above table were taken from the 1921 Annual Report of the Chief of Engineers, U. S. Army. The first cost of all federal improvements on the various channels, locks, canals, and harbors, have been considered for the projects located on Lakes Erie, Huron, Michigan, Superior, and their connecting waterways. Five per cent of this first cost has been added to the annual cost of lock and canal operation and maintenance dredging (averages of the five years 1917 to 1921) to obtain the "Total annual cost."

	No. of Harbors	First Cost New Work to June 30, 1921	Average Annual Maintenance, 1917-1921
Inter-lake channels:			
St. Marys River including locks and canals		$25,587,451	
St. Clair River		821,385	
Lake St. Clair		2,370,483	$270,998
Detroit River		12,869,225	
Duluth District	10	11,417,179	116,754
Milwaukee District	15	7,860,808	138,525
Chicago District	7	11,987,792	130,452
Detroit District	11	6,619,994	102,288
Buffalo District	14	26,829,586	231,757
Total	57	$106,363,903	$990,774

The ton-miles credited to the Great Lakes include only commerce passing through the locks at Sault Ste. Marie—that is, commerce to or from Lake Superior, and represents the average thereof for the five year period 1917 to 1921. No records are readily available which furnish statistics for the shipping between Lake Michigan and Lakes Huron and Erie, nor of the local commerce confined to a single lake. The additional tonnage thus concerned would substantially reduce the figure $0.104 given for the "Great Lakes System" supra.

Detroit, Mich. March 8, 1923. E. M. MARKHAM, U. S. District Engineer.

Protecting Steel Bridges from Locomotive Blast

Sir—The protection of steel bridges from the blast of locomotives is an important question and I read with interest the article on that subject in *Engineering News-Record* of Dec. 7, 1922, p. 968. In the Chicago & Western Indiana R.R. and the Belt Ry. Co. of Chicago we have had considerable success in protecting the underside of overhead steel bridges with poured concrete. As the evidence and conclusions presented in your article were unfavorable to that method of protection, you might be interested in our experience.

The typical condition of the underside of our overhead bridge at Hammond Junction (85th St. and Stewart Ave.), Chicago, is shown in Fig. 1. This bridge was built in 1916, has approximately 17½ ft. clearance, and an I-beam floor encased in concrete. It is similar to the Rock Island Lines bridge over our tracks at 79th St., built two years previously (in 1914) and shown in Fig. 1 of the above article,

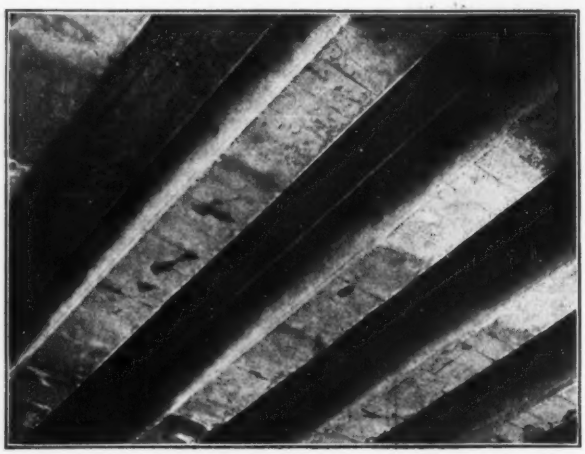


FIG. 1—POURED CONCRETE PROTECTS BRIDGE FLOOR

the principal difference being that the steel at Hammond Junction was encased in poured concrete instead of in gunite. This photograph was taken Jan. 8, 1923, seven years after completion of the bridge.

The concrete is in excellent condition, the form marks still being plainly visible, even directly over the locomotive blast. The small holes in the sides of the concrete casing were provided so that cast iron plates could be installed directly over the blast, but these have never been considered necessary. The tracks that pass under this bridge also pass under the Rock Island bridge at 79th St. (less than a mile north) and the traffic is almost identical at the two bridges. As conditions at those two bridges are so much alike, especially as respects traffic, clearance and age, the excellent condition of the steel protection at both places, concrete at Hammond Junction and gunite at 79th Street, indicates that either concrete or gunite, if of good quality and workmanship, will successfully withstand locomotive blast for a considerable period.

Two other points on our line where concrete protection for steel overhead bridges has given satisfaction are the street viaducts over the Belt Railway at Cicero Ave. and Crawford Ave., at the Clearing yard, Chicago. A long viaduct carries Cicero Ave. over the busy ladder and lead tracks at the west end of the westbound receiving and eastbound departure yards at Clearing. This viaduct was built in 1914 and has 22 ft. clearance. It consists of two plate girders carrying an I-beam floor encased in concrete. The photograph shown in Fig. 2 was taken Jan. 8, 1923, and shows the excellent condition of the concrete directly over a heavy traffic lead after nine years service.

The Crawford Ave. viaduct is of similar construction, located a mile east of Cicero Ave. and at the east ends of the same yards. It was built at the same time, has the same clearance, and the tracks under it likewise carry a heavy switching traffic. Fig. 3 is a general view beneath this viaduct, in which the concrete above the busy leads is in excellent condition. Incidentally, although the exposure

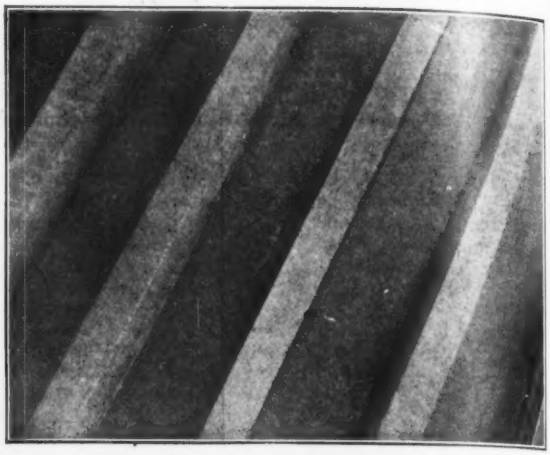


FIG. 2—STEEL I-BEAMS ENCASED IN CONCRETE

for this last picture was only three seconds, the photographer spent nearly an hour getting the picture because of the many engine movements and the resulting smoke.

In addition to the three structures shown in the accompanying figures, the use of poured concrete protection has been made with good results on a number of other structures on these two railroads. Our experience with poured concrete has not been the same as the examples of such encasement referred to in an article of Dec. 7, 1922. In fact we have had fairly good success with the poured concrete protection. Without in any way questioning the results obtained from the use of gunite casing, the writer feels that in view of the successful use of poured concrete

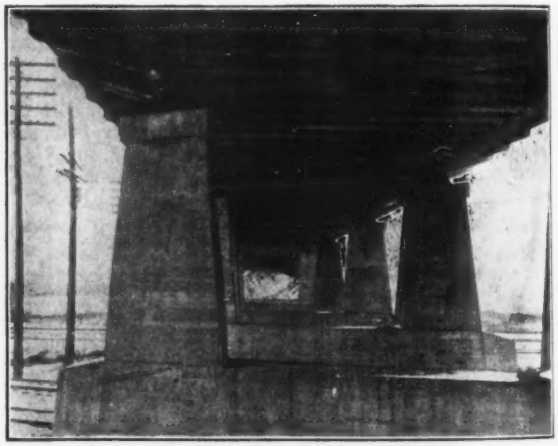


FIG. 3—CRAWFORD AVENUE VIADUCT WITH CONCRETE FLOOR PROTECTION

in certain instances, definite conclusions cannot be stated with respect to this important subject, without a wider investigation than that given in the article mentioned.

F. E. MORROW,
Asst. Chief Engineer: C. & W. I. R.R.

Chicago
Feb. 23, 1923.

Sweden Has 118 Water-Works Plants

Sweden had 118 water-works plants in 1920, with 283 administrative officers and 1,050 "workers," according to the Swedish Year Book for 1922. The population of Sweden at the close of 1921 is given as nearly 6,000,000.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

The permissive city manager bill passed by the recent session of the New Jersey Legislature has been signed by Governor Silzer.

The New Jersey Senate has passed the house bill devoting $875,000 of money to be derived by the state from disposition of the Morris Canal to the purchase of right-of-way for the ship canal proposed to connect the Atlantic Ocean with the Delaware River.

Following rejection of both bids for the Port of Newark, the War Department is seeking to find possible private buyers. The only two bids submitted were those of the City of Newark, $3,000,000; and of Frederick C. Schneider, New Brunswick, $1,000,000.

The salary of T. Chalkley Hatton, chief engineer, Milwaukee Sewerage Commission, has been raised to $15,000 a year. The increase is attributed by the organ of the Engineers Society of Milwaukee to the great importance of the work to be done in the next year, and to appreciation by the commission of the value of Mr. Hatton's services.

Contract for the excavation and concrete work for the additional filter plant for the Baltimore water-works was awarded March 21 to the Carozza-Rowe Construction Co., of Baltimore, the lowest bidder, at $1,248,955. William A. Megraw is water engineer and James W. Armstrong filtration engineer of Baltimore.

Regrouping of railroad systems east of the Mississippi River and north of the Ohio and Potomac Rivers will be considered at hearings on tentative consolidation plans by the Interstate Commerce Commission beginning in Washington May 16. The plan outlined two years ago by the Commission regrouped these systems into nine large groups.

As a result of the disastrous Ward Island fire in New York City recently a bill has been introduced into the New York State Senate proposing an issue of $50,000,000 in bonds for the construction of buildings for the care, support, instruction and training of wards of the state. The bill provides submission of the bond issue to the people at the 1923 general election.

Legislation authorizing a bond issue of $75,000,000 for the construction of a state highway system in Tennessee has just been introduced into the legislature. Under the terms of the bill 4,000 miles of high-class highways will be constructed in 7½ years, using approximately $10,000,000 per year. Bonds are to be retired in 30 years. If passed, the bill will go to the people for a referendum vote.

Illinois Central R.R. to Build to Metropolis Bridge

To meet the requirements of its heavy main-line traffic the Illinois Central R.R. plans a 175-mile diversion in Illinois to connect with the double-track bridge over the Ohio River at Metropolis, thus supplementing the present route over the single-track bridge at Cairo. For this purpose the Southern Illinois & Kentucky Ry. has been incorporated to build a line from Edgewood to Metropolis, Ill., connecting with the Paducah & Illinois R.R. which operates the Ohio River bridge. There is to be a branch also from Akin to Benton to connect with a local coal railroad. The incorporators include C. H. Markham, president of the Illinois Central R.R.

In replying to some objections to the new line which have been advanced by towns along the present route, Mr. Markham has pointed out that the new line will not take traffic from the old one. Furthermore, it will open up a section of Illinois which is not now provided with railway facilities. To increase the traffic capacity of the present line would require grade reduction and double tracking at an estimated cost of $24,000,000, while the cost of the new single track line with a maximum grade of 0.3 per cent will be only about $17,000,000.

Water-Power Bill Commits N. Y. to $200,000,000 Expenditure

Water-power bills have been introduced in both houses of the N. Y. legislature which commit the state to a policy of development at public expense state-owned water powers of the Niagara and St. Lawrence rivers and the transmission to municipalities of electric current and energy involving an ultimate expenditure of $200,000,000.

For this year's activities $1,000,000 is to be appropriated. The work of construction is to be done under the supervision of the state engineer and surveyor who for the purposes of the law is made commissioner of hydro-electric power. Under the appropriation provided the commissioner will organize his bureau, make maps, plans and surveys, ascertain just what municipalities wish to take advantage of the law, and report to the 1924 session of the legislature where the initial development will be made, the cost of construction and the cost of transmission, including the building of the necessary transmission lines. A unique feature of the measure is that under it all existing transmission lines are made common carriers.

Other provisions of the bill include the vesting of complete control of rates in the commissioner of hydro-electric power, and the exclusion of all private enterprise from exploitation of power in the St. Lawrence and Niagara Rivers.

Lower Mississippi Problems Feature Engineers' Meeting

Spring Session of American Society at New Orleans to Discuss Troublesome River

The river and harbor problems of the lower Mississippi River will furnish the technical discussions at the spring meeting of the American Society of Civil Engineers to be held in New Orleans April 18-21. Papers which will be presented include:

"The Work of the Corps of Engineers on the Lower Mississippi," Lansing H. Beach, Major General and Chief of Engineers, U. S. Army; "The Economic Location of Jetties," Henry C. Ripley, consulting engineer, Detroit, Mich.; "The Success of the Levees During the Flood of 1922," A. L. Dabney, consulting hydraulic engineer, Memphis, Tenn.; "The High Water Fight at Old Town, Arkansas, in 1922," Louis H. Parmelee, consulting engineer, Helena, Ark.; "The Mouths of the Mississippi River," Elliott J. Dent, Lieut.-Col., Corps of Engineers, New Orleans; "River Control," John Klorer, city engineer, New Orleans, La.; "Revival of Commercial Transportation on the Mississippi River," M. J. Sanders, manager, International Mercantile Marine and the Frederick Leyland Co., Ltd., New Orleans, La.; "The Port of New Orleans, John F. Coleman, consulting engineer, New Orleans; "The Port Development Problem of the Lower Mississippi," Samuel M. Young, chief engineer, Board of Port Commissioners, New Orleans; "The Necessity of an Experimental Hydraulic Laboratory for the Solution of River Problems," John R. Freeman, Past-President, Am.Soc.C.E.; and "The Economics of Transportation on the "Mississippi River," Senator Joseph E. Ransdell, Louisiana.

Excursions Planned

Besides technical sessions, excursions which are scheduled include one through the old section of the city of New Orleans; another by automobile through the city which will terminate in a tea at the Country Club; and an all-day excursion by steamer to points of interest in New Orleans harbor, Inner Harbor Canal and Lake Pontchartrain.

The address of welcome to the visiting engineers will be given by John M. Parker, Governor of Louisiana. The response will be made by Charles F. Loweth, the president of the American Society of Civil Engineers.

The program as a whole has been prepared under the direction of the Committee on Technical Activities and Publications, of which Richard L. Humphrey is the chairman. The other members are John N. Chester, C. E. Grunsky, John P. Hogan, and J. J. Yates. The local arrangements are in charge of committees under the general chairmanship of W. B. Gregory.

Arch Dam Investigation Body Meets in San Francisco

At a meeting in San Francisco of the recently formed advisory committee of Engineering Foundation on the investigation of arch dams, preliminary plans were laid for carrying on the work, a number of existing dams from which useful information could be obtained by making measurements were selected and the work of making the measurements was assigned. A statement of the organization and purposes of the committee was published in *Engineering News-Record* Nov. 16, 1922, p. 857. The meeting held in San Francisco on Feb. 26 was attended by Prof. C. Derleth, Jr., chairman; F. E. Weymouth, M. M. O'Shaugnessy, D. C. Henny, Wynn Meredith, R. P. McIntosh and Fred A. Noetzli.

Provided sufficient funds are available, the committee proposes to build later one or more small dams for experimental purposes upon which tests can be made to try out various theories and get information that could not be secured by measuring existing dams. Particular attention will be given to deflections and deformations caused by temperature changes as reservoir conditions vary from full to empty.

Decision was made to make complete studies of deflections, stresses, temperature effect, etc., on the following arch and multiple arch dams: Hetch Hetchy and Lake Eleanor dams of the Hetch Hetchy project; Lake Spaulding Dam, Pacific Gas & Electric Co.; dam No. 6, Southern California Edison Co.; Clear Creek Dam in Oregon; Hubart Dam in Montana; and Black Canyon Dam in Idaho; (these last three all under the jurisdiction of the U. S. Reclamation Service); Kerckhoff Dam, San Joaquin Light & Power Corp., and Lake Hodges Dam near San Diego. Measurements on each of these dams will be under the supervision of a local committee of four engineers of which the chairman will be a member of the main advisory committee.

It is expected that the whole investigation will extend over a period of two or three years so as to secure data on all possible reservoir stages.

Funds for this work could be only partly provided by Engineering Foundation and the main part of the necessary money is to be secured from interests that would benefit by the work of the committee. Primarily these benefits are expected to make possible the construction of more economical dams of these types.

Fred A. Noetzli, 605 Market St., San Francisco, is secretary and local treasurer of the committee.

New York Dwelling Tax Exemption Held Unconstitutional

The tax exemption ordinance of New York City under which dwellings of moderate cost put under construction during the two years ending April 1, 1923, were to be exempt from taxation for ten years has been declared unconstitutional by John M. Tierney, a justice of the State Supreme Court.

The legislative act on which the New York City ordinance rests authorized any municipality in the state to make exemptions of the kind indicated. Justice Tierney holds that the act violates Article 3, Section 1, of the New York State Constitution, which prohibits the passage of "a private or local bill granting to any person, firm, or corporation an exemption from taxation on real or personal property."

Speedy appeal to the two higher courts of the state is proposed.

New Jersey Engineers License Law Effective April 8

The New Jersey act licensing professional engineers and land surveyors enacted in 1921, becomes effective April 8. After that date "no county, city, town, township, village, borough, or other municipal corporation or other political subdivisions in the state shall engage in the construction or maintenance of any public work involving professional engineering, or land surveying for which plans and specifications and estimates have not been made by, and the construction of maintenance supervised by a licensed professional engineer or land surveyor." Improvements costing less than $2,000 are exempted. Applications for licenses without examination must be in the hands of the State Board of Professional Engineers and Land Surveyors, 710 Trust Company Building, Jersey City, by April 8.

Colliding Interurban Car in Ohio Wrecks Steel Bridge

An interurban car on the Northwestern Ohio Railway & Power Co.'s line between Toledo and Sandusky struck the trusses of a 100-ft. steel span over Portage River at Oak Harbor on March 7, and wrecked it and went down with the span. There were about twenty passengers on the car, but no fatalities resulted. Investigation showed that the rear truck of the car left the track as the car neared the bridge, causing the car to move over to one side and strike the end post of the bridge. The front truck of the car remained on the track in the fall.

Burlington Line to Build Cut-Off

A 16-mile low-grade single-track cut-off line between Frederick and Vermont, Ill., is to be built by the Chicago, Burlington & Quincy R.R. to avoid the three miles of 1.25 per cent pusher grade against northbound coal and tonnage freight trains on the present line between these points. The new line will have a maximum grade of 0.25 per cent and will save three miles in distance. Passenger trains and local freight trains in both directions, as well as southbound through freight trains (having a large percentage of empty cars), will continue to be operated over the present line. The cost of the new work is estimated at $1,750,000. This improvement has been planned by C. L. Persons, assistant chief engineer, under the direction of A. M. Newton, chief engineer.

Western Society Nominates

Nominations for the officers of the Western Society of Engineers on the official ticket are announced as follows: President, C. A. Morse, chief engineer, Chicago, Rock Island & Pacific Ry.; vice-presidents, E. T. Howson, western editor, *Railway Age;* Horace Carpenter, consulting engineer, the Arnold Co. and H. H. Clark, consulting gas engineer; treasurer, G. W. Hand, assistant to president, Chicago & North Western Ry.; trustee for three years, M. M. Fowler, with General Electric Co.; members of Washington Award Commission for three years, J. L. Hecht, vice-president, Public Service Co. of Northern Illinois, and W. W. DeBerard, western editor, *Engineering News-Record.* A ticket "by petition" may be named at any time prior to April 20.

Shawver Succeeds Emerson as Wyoming State Engineer

Frank C. Emerson, state engineer of Wyoming since 1921 when he was appointed by Governor Robert D. Carey, has been succeeded by Casper D. Shawver, city engineer of Cheyenne. Mr. Emerson was appointed for a six-year term, and when it became doubtful that the new governor would reappoint him he sought, it is alleged, confirmation of his commission at the hands of the 1923 state senate. This alleged usurpation of executive power resulted in the summary dismissal of Mr. Emerson by Governor Ross. However he refused to yield his office to his successor until forced to by court action.

Mr. Shawver was deputy state engineer from 1915 until 1920.

WRECKED SPAN OVER PORTAGE RIVER, AND TIMBER TRESTLE REPLACING IT

N. Y. Power Discussed at Joint Conference

Local Sections of Founder Societies Bring Out Features of Metropolitan District Requirements

The main auditorium of Engineering Societies Building, New York City, was practically filled on the evening of March 21 at the joint meeting of the New York Sections of the four national engineering societies at which was discussed the problem of hydro-electric power for the New York City metropolitan district.

The problem which was to be discussed was outlined in the preliminary paper by Col. F. W. Scheidenhelm, which stated that the conference was called to bring to the attention of the group of societies the question of the availability of hydro-electric power for the metropolitan district, New York City. Col. Scheidenhelm outlined the general problem of the joint utilization of steam and hydro power and emphasized the current development toward having hydro power supplementary to steam rather than the earlier relation in which the opposite occurred. As a result of this there is required what is called excessive development of hydro-power, by which is not meant that there is an engineering waste but that there is a greater development than would be warranted if only hydro power with its low power factor were available.

Super-Power Survey Results

The second speaker was W. S. Murray, consulting engineer of New York, who outlined the main results of the super-power survey of which he was the engineering head in its relation to the New York district. He said that of the great sources in the general eastern district, Niagara would probably eventually come into the New York district whereas the St. Lawrence would eventually come into the Boston and New England district. For the remaining interior streams of New York available for hydro power in New York City there are the Susquehanna, the Delaware, and the Hudson. The Susquehanna is a run-of-river proposition with few storage facilities. It is possible, however, to develop 800,000 hp. in connection with the super-power scheme, The Delaware, on the contrary, is a storage river, with a capacity almost equal to that of the Susquehanna. The Hudson is also a storage river with 150,000 kw. development possible by 1930 and 430,000 kw. in the eventual development of the super-power scheme.

George A. Orrok, of the New York Edison Co., emphasized the characteristics of a metropolitan service such as his company gives. He called attention to the prime necessity of a metropolitan electric service, that is, continuity, and indicated that the danger of severance of this continuity was the main possible objection against the use of hydro-electric power.

Operation of hydro-electric plants was the subject of the paper by F. A. Allner, general superintendent of the Pennsylvania Water & Power Co., which operates the 100,000 kw. Holtwood plant on the Susquehanna River. Mr. Allner showed a number of charts to prove that the continuity service from his hydro-electric plant was remarkably high.

The final paper was by Lorin E. Imlay, consulting engineer of the Niagara Falls Power Co., and detailed the progress which has been made in long distance transmission. These papers took practically all of the evening and in the remaining short period discussion was limited to the formal discussion by Col. J. P. Hogan, consulting engineer of William Barclay Parsons, on the New York State survey of water power, and W. F. Finlay, Jr., vice-president of the American Water-Works & Electric Co.

Additional Paving Brick Variety Eliminated

The Standing Committee on Simplification of Varieties of Paving Brick, co-operating with the Department of Commerce, met in Washington, March 27, and eliminated an additional variety from the "recognized" types and sizes. The variety eliminated is the repressed hillside brick, 4x3½x8½ in.

This variety was eliminated because the committee regarded it essentially as a special brick and because its volume in the year 1922 constituted only 4.1 per cent of the total shipments.

The committee re-affirmed its action of last year in eliminating as a recognized variety the wire-cut-lug hillside brick, the restoration of which had been requested by Frank B. Dunn.

Further details regarding the committee's action and of the survey on which the deliberations were based will be published next week.

More on F.A.E.S. Traveling Expenses

Two of the members of the committee of the Board of Directors of the Am. Soc. C. E. appointed to prepare the arguments for that society joining the Federated American Engineering Societies have commented further on the statement made by C. M. Holland, of the opposing committee, as to the traveling expenses of the F.A.E.S. (*Engineering News-Record*, March 1, 1923, p. 412). These two members, Richard L. Humphrey and Arthur P. Davis, say:

"The undersigned regret that Chairman Holland should attempt to divert attention from his erroneous statement that 'last year traveling expenses alone amounted to $15,000.' by his further statement—'the favorable arguments also are misleading on this point, in that they lead to the inference that only $6,600 was spent for travel during 1922, whereas the statement of the Federation shows that $8,417.65 was spent for that purpose.'

"The statement in the arguments in favor of the society joining the F.A.E.S. is correct; the item for travel in the estimated expenses for 1923 of $8,500 includes $1,900 for the traveling expenses of the secretary leaving $6,600 for the 'mileage for members of the council and of its executive board' as stated in the favorable arguments. Mr. Holland in his ineffectual attempt to point out an error in the favorable arguments makes another misstatement when he says 'the statement of the Federation shows that $8,417.65 was spent for that purpose,' i.e., for travel for 1922. The financial statement of the F.A.E.S. shows that but $7,682.70 was spent for travel in 1922."

Engineering Council Board Would Make Coal Survey

Storage Investigation Authorized At Cincinnati Meeting—Transport Committee Continued

Decision to undertake a nationwide coal storage investigation was reached by the Executive Board of the American Engineering Council of the Federated American Engineering Societies at its meeting in Cincinnati, March 23-24. General endorsement of the plan for government reorganization submitted to Congress with the approval of President Harding and Cabinet, and continuance of the Committee on Transportation, were other features of the meeting.

The object of the coal survey is "to determine the facts relating to the engineering, chemical, and economic factors involved in, and their influence upon coal storage at the mine and by large and by other consumers of coal."

The Coal Commission, it was stated by Executive Secretary L. W. Wallace, was relying upon engineering methods and engineers. The opinion was expressed that the study, to be of the greatest benefit, should be completed not later than November 1.

The Committee on Procedure of the American Engineering Council some weeks ago authorized the appointment of a Committee on Transportation to report to the Executive Board as to what, if anything, the American Engineering Council could do with propriety and effectiveness in relation to the transportation problem of the American people.

Max Toltz, chairman of the committee appointed, made a progress report to the Executive Board, pointing out that the task was such a ramified one that the committee would require more time in which to advise the Executive Board. He further indicated that probably the best service the American Engineering Council could render would be to co-operate with a number of national organizations which had been working in this field for years. It was, therefore, voted to continue the committee, instructing it to continue its conferences with various groups concerned.

J. Parke Channing of New York, chairman of the new Committee on Government Reorganization as Related to Engineering Matters, made a progress report indicating the active participation of the Federation in this sphere. The attitude of the committee toward the plan now before Congress is expressed in the following statement issued by Chairman Channing:

"As a whole engineers favor the proposed plan of reorganization of the executive departments as it applies to engineering activities, upon which activities they feel themselves competent to pass.

"While the proposed plan is not in every detail that one advocated by the National Public Works Department Association, engineers feel that the scheme is a great step in advance."

Concerning the registration of engineers, the following resolution, moved by Gardner S. Williams of Ann Arbor, Mich., was adopted:

"Resolved, That it is the sense of this Executive Board that American Engineering Council should continue to collect and keep up to date a record of the engineers registration and licens-

(*Continued on p. 601*)

Research Main Topic Before Sewage-Works Meeting

Tests by New Jersey Experiment Station Reviewed—Urge Investigation of Potts Charges

The main topic at the eighth annual meeting of the New Jersey Sewage-Works Association, held at Trenton, March 14, was the research work being carried out at the state experiment station, New Brunswick, N. J., under an appropriation of $10,000 made half and half by the State Legislature to the station and to the New Jersey State Department of Health. The association has a research committee which is co-operating in the investigation. The subject was introduced by Dr. Thomas J. Headlee, director of the station. A detailed account of the investigations now being made was given by Dr. Wilhelm Rudolphs. The studies being made are under the direction of a full-time bacteriologist and a chemist, a botanist, and a zoologist, these three giving part time to the work. The investigations embrace detailed observations on what is going on in Imhoff tanks and sprinkling filters at the Plainfield joint disposal works near New Brunswick.

In the discussion of this paper the opinion was expressed by members of the engineering staff of the New Jersey State Department of Health that the Plainfield tanks cannot be taken as representative Imhoff tanks, since they are operated intermittently instead of continuously.

Chemicals in Sludge Drying

Dr. Rudolphs also stated that studies are being made of the use of chemicals to hasten drying on sludge drying beds and that alum for this purpose was giving promising results.

A paper summarizing the experiences in New Jersey under the act providing for the licensing of superintendents and operators of sewage-works was read by C. A. Capen, Jr., assistant sanitary engineer, New York State Department of Health. Candidates for licenses are given instruction by representatives of the department before taking an examination. Altogether 207 licenses have been issued, but some of these have been for a second man at the same sewage-works.

Practically all municipalities in the state seem to think, said Mr. Capen, that their responsibility is ended when they had spent money on the construction of sewage-works; that is, the municipalities generally are unwilling to spend the necessary money for operation. One of the difficulties met is the discharge of the sewage-works operators on change of the party in control of the city administration. Difficulty is also experienced in getting the cities to see the necessity for spending money to send men to Trenton for instruction and examination and to pay for the substitute operator while candidates are away. The State Department of Health notifies cities where the operator has not taken out his license. Beyond this all that can be done in case of failure to take out a license, is to refer the case to the attorney general.

The association adopted a resolution requesting the governor of the state to make a speedy investigation of the charges against Clyde Potts (a member of the association) brought by the Direct Oxidation Disposal Corporation in connection with the alleged delay of the State Board of Health in acting upon the Trenton sewage-works plan. The resolution requested investigation not only of the charges against Mr. Potts, but also an investigation of the standing of the company.

The election of officers resulted in the continuation in office of S. Fisher Miller as president and Myron E. Fuller as secretary and treasurer.

Walter J. Francis Succeeds to Canadian Institute Presidency

Following the death of Arthur St. Laurent, who was president of the Engineering Institute of Canada (see *Engineering News-Record*, March 15, p. 510), Walter J. Francis, consulting engineer of Montreal and senior vice-president of the Institute, was made president at a regular meeting of the council on March 27.

Mr. Francis' earliest professional experience was secured, after graduation from the University of Toronto, in railroad work in Canada. In 1898 he entered the service of the Department of Railways and Canals of Canada having charge of the design and construction of lift locks on the Trent canal. Later he was in charge of the construction of a large hydro-electric plant for the West Kootenay Power Co. and in 1907 was made assistant manager and chief engineer of the Dominion Engineering & Construction Co. of Montreal.

Mr. Francis was engineer for the royal commission of inquiry into the Quebec bridge disaster and reported on the wreck, developing in detail the theory for the collapse. Since 1910 his consulting work has included, among other things, designs and reports on many hydro-electric and steam power plants, investigations and reports on buildings, especially foundations, and municipal investigations for Edmonton and other Canadian towns and cities.

Besides being a member of the Engineering Institute of Canada, he is a member of the American Society of Civil Engineers, a charter member of the American Institute of Consulting Engineers, a member of the Institution of Civil Engineers, and various other technical, semi-technical, and social organizations.

$10,000,000 Appropriated for Washington State Roads

At the recent session of the Washington State Legislature $10,314,245 was appropriated for a two-year road program, which has been initiated this year. In addition, $300,000 was made immediately available for maintenance work, $1,670,000 for continuing work on the Pacific Highway, and $1,000,000 to match federal aid. The legislature also changed the title of the supervisor of highways to state highway engineer and transferred him from under the supervision of the department of public works to the highway commission, which is composed of the governor, state treasurer and three appointed members.

Failure to Ratify Compact Holds Up Power Projects

Colorado River Developments Postponed Aggregate More Than $100,000,000

Washington Correspondence

Failure to ratify the Colorado River Compact is regarded by Federal officials as a greater calamity to the West than is generally appreciated at present. The fourteen major projects which have been halted by the action of Arizona, if allowed to proceed would contribute very importantly to the prosperity of the entire West. It happens that Arizona itself is affected adversely as much, if not more, than any single state. The only encouraging aspect of the situation is that the compact stands and can be ratified at any time in the future.

The Girand project at Diamond Creek involves the ultimate investment of $70,000,000. The initial investment would be two-thirds of that amount. This project, from which Arizona would be practically the entire beneficiary, is delayed indefinitely along with the other thirteen projects.

Another of the large projects which is delayed is that of the Southern California Edison Co., which contemplated the development of a series of projects, the most important of which was the great reservoir at Lee's Ferry. That company was prepared to begin preliminary investigation and work immediately on the ratification of the compact. In that instance the delay is likely to work against the best interests of the Colorado basin since it is forcing the Southern California Edison Co. to commit itself more and more to the development of higher cost power on the headwaters of the San Joaquin. Imperial Valley suffers from the fact that the development planned by the Southern California Edison Co. would have done much to move the flood menace on the lower river.

The Flaming Gorge project of the Utah Power and Light Co. on Green River is another of the big projects halted by the failure to ratify. That company is ready to go ahead with its project which would develop 100,000 hp. and create a storage of 1,500,000 acre-ft.

The plans of the Denver Gas and Electric Co. for the development of power at Kremmling on the Colorado have been interfered with seriously. The fact that the company is preparing to erect a large steam plant near Boulder indicates that it has lost hope of being able to develop the Kremmling site in time to meet the demands which will be made upon it for additional power.

Fourth Firestone Road Essay Contest Announced

The Highway Education Board, Washington, D. C., has announced the fourth annual road essay contest which carries a prize of a four-year university scholarship. This year's subject is "The Influence of Highway Transport Upon the Religious Life of My Community." The contest is open to high school students throughout the country and essays are to be submitted to the respective high school principals by May 1. The donor of the scholarship is Harvey S. Firestone, of Akron, Ohio.

A. R. E. A. Appoints College Co-operative Committee

Personnel of the committee of the American Railway Engineering Association on co-operative relations with universities has recently been named as follows: Chairman, R. H. Ford, assistant chief engineer, C. R. I. & P. Ry.; R. N. Begien, general manager, B. & O. R.R., Western Lines; W. C. Cushing, engineer standards, Pennsylvania System; J. M. R. Fairbairn, chief engineer, Canadian Pacific Ry.; W. O. Faucette, chief engineer, Raleigh & Charleston R.R.; E. T. Howson, editor *Railway Age;* E. B. Katte, chief engineer, electric traction, N. Y. C. R.R.; C. A. Morse, chief engineer, C. R. I. & P. Ry.; G. J. Ray, chief engineer, D. L. & W. R.R.; H. R. Safford, vice-president, C. B. & Q. R.R.; W. B. Storey, president, A. T. & S. F. R.R.; Dean Wm. G. Raymond, State University of Iowa; Prof. Henry E. Riggs, University of Michigan; Prof. George F. Swain, Harvard University; Brig. Gen. C. H. Mitchell, dean faculty of applied science, University of Toronto. A few more may be added. The details of the organization of the committee were worked out by H. R. Safford, E. H. Lee and J. M. R. Fairbairn. In *Engineering News-Record,* Feb. 1, p. 201, the scope and purpose of the committee were noted.

Engineering Council Board Would Make Coal Survey

(*Concluded from p.* 599)

ing laws . . . for use of the constituent societies of the Federated American Engineering Societies and others, but that it assumes no control over the actions of such constituent societies in regard thereto."

The Executive Board voted to cooperate in the movement to bring about uniform safety legislation, to broaden the program of its Reforestation Committee, to study the question of constituting the American Engineering Council a clearing house on elimination of waste, and to work with the National Safety Council in plans for Conservation Week.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Annual Convention, Norfolk, Va., May 7-9.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Spring Meeting, New Orleans, La., April 18-20.

NATIONAL FIRE PROTECTION ASSOCIATION; Boston; Annual Meeting, Chicago, May 8-10.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, Detroit, Mich., May 21-25.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual Meeting, Atlantic City, N. J., June 25-29 or 30.

The Providence Engineering Society will hold a joint meeting of its power and textile sections March 30, at which time Arthur T. Safford will speak on twenty-five years' progress in the use of water power with auxiliary steam power in New England textile mills.

The Social Organization of Hungarian Engineers, New York, recently elected the following officers: President, Alexander Strobl; vice-president, Dr. Adalbert Edek, of the Rockefeller Institute; secretary-treasurer, Julian J. Wittal, consulting engineer.

The Harvard Engineering Society will elect officers at the annual meeting to be held in New York, April 19. The nominating committee has prepared the following ballot: President, Charles J. Tilden; first vice-president, Lionel S. Marks, Cambridge; second vice-president, Charles Gilman, New York City; secretary, Theodore R. Kendall, New York City, and treasurer, Edric B. Smith, New York City.

Personal Notes

IVAN C. PETERSON and L. O. HOPKINS, formerly manager and chief engineer, respectively, of the Chicago Bascule Bridge Co., severed their connection with that company on Mar. 1, and are now engaged in a consulting engineering practice, specializing in movable bridge design, under the firm name of Peterson, Hopkins & Co., at 118 North La Salle Street, Chicago, Ill.

FRANK W. DEWOLF has resigned his position as chief of the state geological survey of Illinois to become chief geologist of the Humphreys-Fohs oil interests, with office in the Great Southern Life Building, Dallas, Texas.

Dr. IRA N. HOLLIS, since 1913 the president of Worcester Polytechnic Institute, has tendered his resignation to the Board of Directors. Dr. Hollis will remain with the Institute until a successor has been secured. He wishes to leave teaching work to devote some time to literary work. After graduation from Annapolis in 1878 Dr. Hollis spent three years in the Mediterranean, cruising, later being promoted to the grade of assistant engineer and being assigned as professor of marine engineering at Union College, Schenectady. In 1884 he served on the advisory board that built the four ships of the White Squadron and spent some months in the inspection of machinery on the Atlantic coast. On the West coast he spent three years at the Union Iron Works where some of the early ships for the new navy were then building. Previous to his election to the presidency of Worcester Polytechnic Dr. Hollis was professor of engineering at Harvard to which position he was elected in 1893. Dr. Hollis is a former vice-president and past-president of the American Society of Mechanical Engineers.

HERMAN FOUGNER, for some time past president of the Fougner Concrete Steel Co., New York City, has been elected vice-president of Thompson-Starrett Co. also of New York. Mr. Fougner has for a long time been prominent in concrete and structural steel design and construction and has served various organizations in technical and executive capacities. He was with Milliken Brothers, New York City, for a number of years, serving them not only in the New York office but in Port Arthur, China, where as engineer, he superintended the erection of the extensive steel construction in the Imperial Russian Navy Yard. He also was the sole representative of Milliken Brothers in the Far East. Later he became head engineer in the Johannesburg branch in South Africa. His early engineering in the United States was with the Pencoyd Iron Works and the American Steel Foundry Co., the latter of St. Louis.

E. W. DAVIS, county engineer of Gregg County, Texas, has been appointed county engineer of Anderson County, at Palestine.

ANDREW HAMILTON of Hamilton & Shreve, consulting engineers of Fayetteville, Arkansas, has been appointed district engineer for the National Lime Association at Dallas, Texas.

M. H. MACLEOD, vice-president in charge of construction, Canadian National Railways, has been appointed consulting officer to the executive board of the road.

A. H. NICKERSON, who since 1904 has been with the American Agricultural Chemical Co., has resigned to accept a position with Stone & Webster, Inc., in the mechanical division. Mr. Nickerson started with the former company as chief engineer, holding that position until 1921 when he was made manager of the manufacturing department.

O. THAGE is now connected with the St. Louis Structural Steel Co., steel fabricators of East St. Louis, as a structural engineer. He formerly occupied a similar position with the St. Joseph Structural Steel Co. of St. Joseph, Mo.

GEORGE C. STOWELL has become associated with H. J. Kemper, general contractor of Los Angeles, Calif., as construction engineer. He was formerly a superintendent of construction for the Home Builders Service Bureau of Atascadero, Calif.

JOHN R. CALDWELL, of Madison, Wis., has been appointed county engineer for Dane County, Wisconsin, to succeed E. J. SMITH who has resigned to enter private practice.

HERMAN GUISE, of Kewaunee, Wis., has been appointed county highway engineer for Kewaunee county to succeed MOSES SHAW, who has resigned.

G. L. CHURCH is now employed on survey work with the Mississippi River Commission, third district, engaged principally in revetment and levee work. He was formerly an assistant engineer with the Southern Improvement Co. Mr. Church is stationed at Grand Lake, Ark.

H. F. HAUSLEIN is now structural engineer with the Concrete Steel Co., having recently severed his connection with Andrew Kent Robertson as sales engineer.

THE RANDOLPH-PERKINS Co., consulting engineers, Chicago, have been retained by the City of Terre Haute, Indiana, to make a preliminary investigation and report on a comprehensive plan for reconstructing and extending the present sewer system. The probable cost will be $1,000,000.

R. A. C HENRY, formerly special engineer, Department of Railways & Canals, Ottawa, has been appointed director of the bureau of economics of the Canadian National Rys.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Water-Works Manufacturers Name Convention Committees

For the annual convention of the American Water Works Association, to be held in Detroit, May 21-25, the Water Works Manufacturers Association has announced, through President Edgar J. Buttenheim, the personnel of five committees as follows:

Transportation—Chairman, Walter H. Van Winkle, Water Works Equipment Co., New York; T. C. Clifford, Pittsburgh Meter Co., East Pittsburgh; Raymond Simon, R. D. Wood & Co., Worcester, Mass.; Joseph Ivy, American Cast Iron Pipe Co., Kansas City, Mo.; H. Brown, Neptune Meter Co., Chicago, Ill.; H. M. Lofton, Columbian Iron Works, Chattanooga, Tenn.

Entertainment — Chairman, Burt Hodgman, National Water Main Cleaning Co., New York; William Sherwood, Hersey Manufacturing Co., New York; John H. Stutt, E. I. Du Pont de Nemours Co., Philadelphia; John F. Reagan, Neptune Meter Co., New York; George Smith, Michigan Valve & Foundry Co., Detroit; Vincent McCarthy, R. D. Wood & Co., Chicago.

Exhibit—Chairman, George McKay, Jr., Leadite Co., Philadelphia; J. D. Capron, U. S. Cast Iron Pipe & Foundry Co., Philadelphia; C. C. Benney, Simplex Valve & Meter Co.

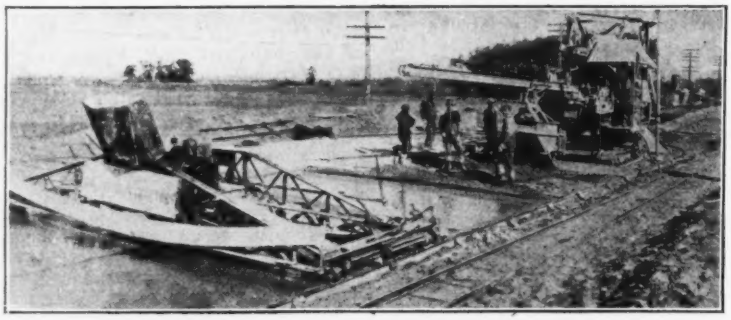
Golf—Chairman, M. F. Tiernan, Wallace & Tiernan Co., Newark, N. J.; Karl Mann, "Fire & Water Engineering," New York; E. Case, Pitometer Co., New York; John Sosnowski, Board of Water Commissioners, Detroit; R. W. Conrow, Central Foundry Co.

Press—Chairman, I. S. Holbrook, *Engineering News-Record*, New York.

Sack Supersedes Barrel as Unit of Measurement for Cement

As the unit of measurement for the quotation, sale and invoice of portland cement, the sack instead of the barrel was adopted by the Marquette Cement Manufacturing Co., Chicago, March 19. In announcing its new policy the company says that "there is no logical reason why a product shipped and used by the sack should be quoted and sold on another unit of measurement." Users of the Marquette company's product are requested to order by the sack instead of by the barrel, four sacks being the equivalent of 1 bbl.

Inquiry at the New York office of the Portland Cement Association developed the fact that no concerted move among the country's cement producers to adopt the sack unit of measurement was contemplated.



How "Ideal Section" of Lincoln Highway Is Being Built

Mechanical equipment is playing a large part in the construction of the "Ideal Section" of the Lincoln Highway, the 1½-mile length of 40-ft. concrete pavement between Dyer and Schererville, Ind., 32 miles south of Chicago. The pavement is being constructed in half widths, comprising 20-ft. strips, for which the concrete is finished with a Lakewood road finisher shown in the accompanying photograph, following close behind a Koehring paver. The contractor is J. C. O'Connor & Sons, Fort Wayne, Ind.

Following the completion of the first half of the pavement the standard wheels of the finisher were replaced with a special set, the outside ones being double-flanged while those on the inside, which traveled on the finished concrete, had a flat tread. The photograph shown is from the files of the Lincoln Highway Association. A detailed description of the design of the "Ideal Section" by W. G. Thompson, consulting highway engineer, appeared in "Engineering News-Record" of June 15, 1922, p. 982.

Alabama Power Co. Makes Aerial Survey of Tallapoosa Basin

As a preliminary step in studies for the development of additional power the Alabama Power Co., Birmingham, has undertaken an aerial survey of the Tallapoosa River basin involving about 500 sq.mi. of hilly country in eastern Alabama. The methods employed follow, in general, those used in the aerial survey of the Tennessee River in 1921 (see *Engineering News-Record*, Oct. 5, 1922, p. 552). On the new work, however, a number of improvements in technique will be made as the result of experience on the previous work. The technical direction of the survey for the Alabama Power Co. is in charge of Gerard H. Matthes, U. S. assistant engineer, Chattanooga.

Should Equipment Makers Feature Record Runs?

Opinion Favors Conservatism—Average Daily Performance the Best Criterion of Service

In last week's issue (p. 559) a discussion of policy regarding the featuring of record runs or performances of equipment and materials was opened by K. H. Talbot, speaking for the Koehring Co., Milwaukee. In this and succeeding issues the points of view of other manufacturers will be given.—EDITOR.

BY H. E. BILLINGTON

Vice-President for Sales, Thew Shovel Co., Lorain, Ohio

WE DO not favor the featuring of record runs in our advertising but we do at times mention results obtained on specific jobs under specific conditions. In every case a photograph is included which shows the nature of the work and the surrounding conditions.

There are so many factors entering into the results which may be obtained by any shovels that we hesitate even to make guarantees. This is not a matter of design or workmanship so much as the specific conditions under which they work. Much of the efficiency of any machine depends on the operator. The class of material to be handled must be considered. Then the matter of transportation is important. There are very few shovels that cannot handle more material than can be taken away from them unless they are of a size which is obviously too small for the job.

While the experienced contractor cannot be fooled by figures obtained on ideal jobs under ideal conditions or by figures which represent a record-day run under pressure, the man just entering the field may be misled. This may cause him to bid on jobs at a figure too low to be profitable to him or anyone else. This action is, of course, reflected on the seasoned contractor who actually knows his costs.

Our policy is based on the belief that the advertising of record runs injures the new contractor, injures the older contractor through inexperienced competition and injures us through the consequent depression.

BY W. A. CATHER

General Sales Assistant, Worthington Pump & Machinery Corp., New York

SHOULD record runs be advertised? Certainly yes—and also positively no! To my mind the whole matter depends upon one thing, namely, the impression created in the reader's mind.

Some machines operate almost automatically. They are started and stopped by hand, but in between these two events the machine takes care of itself; a steam pump is representative of this group. I believe that if Worthington builds a certain type of steam pump that is above the usual in quality and the ability to live long, giving us an example of long service, we are justified in advertising this particular performance. The impression we wish to give is that this style of pump is durable, and if the pump is durable no harm and some good is done.

Along these lines is an advertise-

ment featuring a Worthington gas engine that broke all records for continuous operation. This was due in a very large measure to the machine itself—so we advertised the record run.

There are, however, certain machines whose capacity and performance depend so much upon the skill with which they are operated that it is quite misleading to quote records. An exaggerated example of this can be had in an ordinary shovel. The output, or capacity here is entirely up to the man who handles the shovel. In a lesser degree the same is true of steam shovels and concrete mixers. In such cases there may be some reasonable doubt as to the advisability of advertising big capacity records, unless the copy is prepared in such a way as to produce the impression that the machine under discussion is capable of standing hard, severe and ordinary machine breaking service.

In our work we have not been able to draw a definite line in this matter but decide each case separately. We did and still do advertise the world's record for gas engine continuous duty. But we deliberately laid aside the truly marvelous record of low maintenance cost for several hundred water meters. Why? Simply because we didn't want to create the impression that *all* of our meters would do the same.

By Lion Gardiner
General Sales Manager, Lakewood Engineering Co., Cleveland

I AGREE with Mr. Talbot's comments relative to the use of record runs in advertising matter. Such runs are misleading, particularly because the stage frequently is set to make a good showing through tuning up the organization for the run and being sure that there is an adequate supply of material available.

When we consider the factors of material and labor supply, weather conditions and similar variables which so materially affect the job progress, it must be admitted that as a basis for estimating such data are not valuable. There may be the indication of maximum capacity from a mechanical viewpoint, but what really counts is the day-in-and-day-out continuity of operations. From this viewpoint long-time average runs will offer more benefit to the manufacturer, and at least be of more value to the reader, than the occasional flashes.

In the same category falls the publishing of cost data in terms of dollars. Nothing can be gained unless the number of men, the hourly rate and many other conditions are given. For example, the fact that a steel tower can be erected for $1.50 per foot might mean one thing in an open territory but be an entirely different figure under highly unionized conditions. Data such as are under discussion require careful analysis and a complete account of the variable conditions; otherwise their influence may be unfortunate.

By R. G. Miller
Secretary and Sales Manager, Browning Co., Cleveland

WE CERTAINLY agree with the Koehring Co. and do not believe in any kind of a display which will mislead prospective purchasers. In a few cases we have based our advertising on performances of certain cranes, but these have always been average runs and where the cost of operation has been used, it has been taken over a period of from 10 to 12 years.

Some members of our organization feel that possibly we are a little too conservative in our statements, but our policy is to sell locomotive cranes only when they are the most efficient machinery possible for the job.

By Julius S. Holl
Advertising Manager, Link-Belt Co., Chicago

I AGEE with Mr. Talbot. On all engineering jobs designed and built by this company, our policy is to withhold advertising for one year. Thereafter, we can advertise a performance and not a promise of a performance. Mr. Piez, our president, made this ruling some 15 years ago.

Most new products brought out by this company are manufactured on a small scale and sold to customers who will try out the machines under varied conditions of service. Sometimes we wait several years before we attempt to exploit, through advertising, the merits of such equipment. The Link-Belt automatic chain tightener used on automobile front ends was sold two years before any advertisement of it appeared in the trade press.

(To Be Continued Next Week)

Additional Comment

Forthcoming issues will contain comment on the subject of record runs by:

H. S. Strouse
Pawling & Harnischfeger Co.
H. B. Bushnell
Western Wheeled Scraper Co.
H. T. Gracely
Marion Steam Shovel Co.
J. H. Gregory
Barber-Greene Co.
D. C. Grove
Blaw-Knox Co.
M. Ramsay
Bay City Dredge Works.
C. F. Messinger
Chain Belt Co.
C. F. Ebert
Osgood Co.

Business Notes

W. J. Savage, since 1920 manager of sales has been promoted to the position of vice-president of the Heltzel Steel Form & Iron Co., Warren, Ohio.

B. C. Collier, vice-president and general manager of the Cement Gun Co., Allentown, Pa., has been made president of the company, succeeding W. J. Roberts, who recently resigned.

James Allinson, formerly manager of the New York office of the Allison Steel Products Co., has been appointed sales manager, succeeding James L. Barrett, resigned.

Charter Gas Engine Co., Sterling, Ill., announces the purchase of the entire Mietz oil-engine business heretofore carried on in New York City by the August Mietz Corp. and the Reliance Oil Engine Corp. All physical assets of the Mietz organization are being moved to the Charter plant in Illinois.

C. B. Gould, formerly sales engineer in the home office of the Barber-Greene Co., Aurora, Ill., has been made district manager and placed in charge of the company's office in Detroit. Mr. Gould is a graduate of the University of Illinois and has served with the company more than a year. He was previously with the engineering and erection department of the Stephens-Adamson Co.

Clifford F. Messinger, for the past three years general sales manager of the Chain Belt Co., Milwaukee, has been elected second vice-president. He was graduated from the Sheffield Scientific School, Yale University, in 1911 and entered the employ of the Chain Belt Co. the same year, where he has occupied the positions of advertising manager, manager of concrete mixer sales and general sales manager. He is also a director of the company and a director of the Interstate Drop Forge Co., Milwaukee.

Q. & C. Co., New York City, has been placed in charge of sales for the Interstate one-piece guard rail formerly manufactured and sold by the Interstate Railway Supply Co., Cleveland. The device will be known as the Q. & C. Interstate one-piece guard rail. This company has also been appointed sole selling agent for the Trench-Zepp stone ballast cleaner, made by Littleford Bros., Cincinnati. The device will be known as the Q. & C. Zepp stone ballast cleaner.

Reading Iron Co., Reading, Pa., manufacturer of wrought-iron pipe, has appointed Lawrence F. Whitney as assistant to G. Bronson Philhower, Jr., district sales manager for New England, with headquarters at Boston. Mr. Whitney had formerly served with the Kay Manufacturing Co., South Norwalk, Conn., and is the inventor of the free floating flexible shaft coupling which bears his name.

Toch Bros., New York City, announce the removal of their executive and sales offices from 320 Fifth Ave. to 110 East 42nd St., New York. This is the fourth move that the company has made in seventy-five years.

C. J. Jackson has been appointed to the sales force of the G. Drouvé Co., Bridgeport, Conn., manufacturer of Anti-Pluvius skylight and sash operators.

Federal Paving Co., Chicago, at its recent annual meeting underwent a reorganization. Frank Novotny was elected president, succeeding W. S. Pace, who has severed his connections with the organization. The other officers elected were: B. Weis, vice-president; Morris Sabath, treasurer; and Albert Sabath, secretary.

A. S. Mirick has been appointed district engineer of Western Pennsylvania, with headquarters at Pittsburgh, for the Eastern Paving Brick Manufacturers' Association. Mr. Mirick is a graduate of Cornell University and has had an engineering experience extending over a period of more than 20 years, a large portion of that time in charge of road and street paving. Among other connections, he has been with the New York State Highway Commission, the State of Nebraska, as chief road engineer and lately in private practice as consulting engineer on municipal and highway construction.

Equipment and Materials

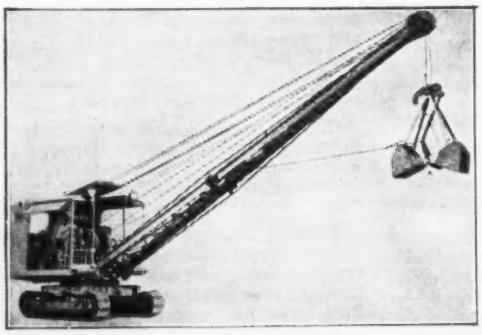
Improved Shaft Bearing for Light Centrifugal Pump

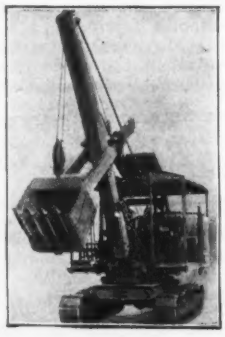
The Evinrude Motor Co., Milwaukee, announces a recent improvement in the bearing equipment of its contractor's light-weight centrifugal pump. To support the pump shaft at the lower end a ball thrust bearing has been provided in place of the lignum vitae plug heretofore used. After a six months' test the company has found that the ball bearing greatly increases the life of the lower bearings and also makes the pump operate more effectively. This improvement can be installed in pumps now in the hands of users.

Crane Excavator Combines Five Units in One Machine

Combining five units in one machine the gasoline crane excavator made by the Koehring Co., Milwaukee, may be used as crane, dragline, clamshell, pile driver, or power shovel. All models are equipped with four-cylinder gasoline engines and mounted on multiplanes. Three sizes of machines are provided having lifting capacities at 12-ft. radius of 7, 12, and 20 tons.

Among the distinctive features claimed by the manufacturer for this crane excavator is its interchangeability on clamshell or dragline work, where it is necessary merely to change buckets and shift a clutch. The outfit uses a two-line speed, the higher speed for clamshell and the lower for dragline operation, resulting in a greater yardage of clamshell work than could be obtained by a machine limited to speed designed only for dragline work. Conversion of the outfit to a power shovel is effected by a change of booms and the addition of dipper handle.





Stress is laid upon the ability of the Koehring crane excavator to boom in and out under load continuously, a desirable feature in restricted quarters. This result is accomplished by the use of a spurgear drive, preventing cutting of the threads, and by an outside double equalizing band friction clutch equalizing stresses on boom members. An advance in design also is claimed for the steering mechanism, which, by shifting one lever to any of four positions, makes the machine turn right or left or travel forward or backward, at high speed or low speed. All levers are banked at the front right-hand side.

Portable Acetylene Generator

The Alexander Milburn Co., Baltimore, manufacturer of oxyacetylene welding and cutting equipment, has recently placed on the market an addition to its line in the form of a portable acetylene welding generator designed to obviate the use of high-pressure cylinders. The generator is of 30 lb. carbine capacity, or equivalent to 150 cu.ft. of cylinder gas. It has few parts, operates automatically without clock or motors and has a steel body, welded throughout. All parts are accessible.

This generator is intended to meet a demand for a source of acetylene gas without the transportation delays and higher costs of depending on cylinder gas. It weighs 200 lb., is 5 ft. 3 in. high and has a diameter of 24 in. at its base.

Welding Detail Aids Reclamation of Steel Valve Bodies

The fact that the composition of the filler rod often has much to do with the success of oxyacetylene welding is demonstrated in the following instance cited by the Linde Air Products Co., New York:

A valve manufacturer, who was successfully employing oxyacetylene welding to reclaim iron castings in which defects showed up during machining, was not meeting with equal success in his attempt to reclaim defective cast-steel valve bodies. This manufacturer made many efforts to overcome the difficulties he encountered and finally consulted an oxyacetylene engineer.

After the engineer had made several test welds, using different kinds of filler rod, he found that a particular rod, which the manufacturer had never tried, produced satisfactory welds on the cast-steel valve bodies. This discovery has resulted in the reclamation of quantities of defective cast-steel valve bodies, and in the saving of considerable time formerly wasted on unproductive machine work.

NATIONAL LUMBER MANUFACTURERS ASSOCIATION held its twenty-first annual meeting at the Grunewald Hotel, New Orleans, March 21-22.

Publications from the Construction Industry

Mechanical Mucking — LAKE SUPERIOR LOADER CO., Duluth, Minn., explains in a 24-p. illustrated booklet the operation of its mechanical mucking device, called the Shuveloder, for handling broken rock in tunnels and mines. The device is operated by compressed air and has an overall length of 6 ft., width of 4 ft., and height of 4½ ft., and weighs 4,600 lb. A dipper pivoted on a pair of arms is crowded into the material to be loaded, swung upward through a vertical arc of about 270 deg., and discharged into narrow-gage cars directly behind the machine. The booklet presents operating data in the form of several reports indicating the economy of the Shuveloder over hand mucking.

Rail Steel Reinforcement—The volume which was reviewed in this column in the March 15 issue, p. 515, and credited to the Laclede Steel Co., St. Louis, was published by the Reinforcing Bar Division of the Rail Steel Products Association, of which the company named is a member. The following companies, members of the association, are in a position to distribute copies of the book: Laclede Steel Co., St. Louis; Calumet Steel Co., Chicago; Inland Steel Co., Chicago; Burlington Steel Co., Ltd., Hamilton, Ont., Can.; Buffalo Steel Co., Tonawanda, N. Y.; Pollak Steel Co., Cincinnati.

Road Building Equipment — GOOD ROADS MACHINERY CO., INC., Kennett Square, Pa., has published an illustrated general catalog of 48 pp. covering its line of road and street building machinery. The equipment, which is explained in detail, includes road graders with blades ranging in length from 5 to 10 ft., all-steel road drags of three types, including a two-blade, a three-blade and a three-way drag designed to cover a road 18 ft. wide, both stationary and portable rock crushing and screening equipment, road rollers, scarifiers, pressure distributors for bituminous materials, and heating kettles.

Pile Hammers — MCKIERNAN-TERRY DRILL CO., New York, in a 68-p. illustrated bulletin just published, makes an unusually complete presentation of the uses on various types of construction of its eight sizes of light and heavy double-acting pile hammer operated either by steam or compressed air. After a brief description of the design and operating features of this equipment and data on typical performances, the bulletin devotes 26 pp. to illustrations and descriptions of the pile hammers on jobs involving light and heavy sheetpiling (both timber and steel), round wooden piles, pipe piles, and batter or brace piles. These pages are replete with hints as to rigging for a wide range of conditions. There is a discussion, with sketches, of pile hammer ways and leads and the selection of the proper size of hammer. The booklet concludes with detailed specifications, lists of repair parts, and information on pile pulling with the McKiernan-Terry hammers.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Car Shortage Relief in Quicker Moves and Heavier Loads

That the greatest transportation necessity today is the addition of improvements that will move freight cars faster, and action on the parts of shippers to utilize them to more nearly their full carrying capacity, is brought out in the following statement by Mr. M. J. Gormley, chairman of the Car Service Division of the American Railway Association, in his address before the Cincinnati Traffic Club, March 13:

There existed during the first eight months of 1922 an average daily surplus of equipment for the entire country of 270,750 cars. The severe shortage began about September 1 with a shortage of 58,670 cars and reached a peak of 179,239 on October 31.

From 1912 to 1922 this country experienced 30 months of car shortage with a maximum at any one time of 179,000 cars. During the same period there has been 90 months of surplus with the surplus reaching a maximum of 495,000 cars.

DIFFICULTY NOT LACK OF CARS

A great many people attribute the difficulties during 1922 to a lack of cars and make the statement that what is needed is additional cars and some new theoretical way of handling them. We believe the records will justify the statement that the shortage in 1922 was more largely made up of transportation shortage than car shortage. In substantiation of this statement, we have figures to indicate that if all of the cars of the country during the months of September, October and November, 1922, had moved at the rate of thirty miles per car per day instead of the average actually made of 25.9 miles per car per day it would in effect have resulted in adding 333,903 cars to the ownership. It is well recognized that thirty miles per car per day is an ideal figure and has been closely attained in the past, and without abnormal interference might have reached that point during the months mentioned. Generally speaking, it should be remembered that on the basis of the present car ownership of the country, the addition of one mile per car-per day in the movement has the effect of adding approximately 100,000 cars to the ownership.

Likewise if all the cars of the country had been loaded to an average of thirty tons per car, a figure attained in the past at different times, instead of the actual average of 27.7 tons per car, it would in effect have added 188,357 cars to the ownership.

Therefore, we are firmly of the opinion that the greatest necessity today is the adding of improvements that will move the car faster and action on part of all interested to utilize it to more nearly its carrying capacity. This involves locomotives, additional main lines, extension of yard facilities, enlarged shops, enlarged engine houses, and in our opinion, lastly comes the question of additional cars.

Business Briefs

Call money advanced to 6 per cent, March 26, for the fourth time this year, due to recall of funds by interior banks. Last week 5@6 per cent; year ago, 3½ @6 per cent.

Time loans quiet at 5¼ per cent, March 26. Last week, 5¼@5½ per cent for 60@90 days; year ago, 4½@5¼ per cent.

Commercial-paper firm at 5@5¼ per cent; unchanged during week, with year ago rate, 4½@5¼ per cent.

Bank debits, $10,188,000,000 for week ending March 23, against $9,355,000,000 for preceding week. Gain due chiefly to payment of first instalment of 1922 income taxes.

Foreign exchange shows strong recovery in French and Belgian francs. French franc, March 26, 6.61c.; week ago, 6.46c.; year ago, 8.94½c. Belgian, 5.71½c.; week ago, 5.56½c.; year ago, 8.32c. Mark at .48⅛c.; week ago, .48¼c.; year ago, 30½c.

Building permits for February valued at $216,748,197 in 149 cities, against $133,011,394 in same month last year, according to Bradstreet's.

Commercial failures (Dun's) totaled 391 for entire country, week ending March 22, against 544 during same week in 1922.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News pp. 177 to 191, are the following:

Office building, Philadelphia, Pa., for C. H. K. Curtis, $5,000,000.

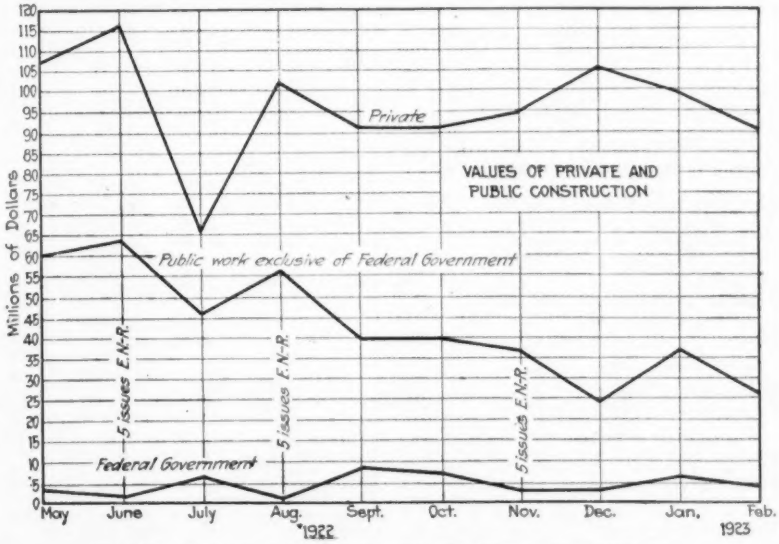
Bank, St. Louis, Mo., for Federal Reserve Bank of St. Louis, $2,500,000.

(*Continued on p. 606*)

If Government Postpones Letting Contracts

Federal Work Only 3 Per Cent of All Construction—Other Public Work 29 Per Cent

Mr. Hoover's advocacy of restricted federal construction at this time, in view of the economic situation in the industry, makes pertinent a brief inquiry into the probable effect of such a policy. Of the billion and a half of contracts reported last year in Construction News, only 2.8 per cent were for federal government projects. Since Jan. 1, this year, large contracts of all kinds totaled about $420,000,000, of which $12,000,000 or 2.9 per cent was federal, exclusive of government buildings.



VALUE OF LARGE PRIVATE AND PUBLIC CONSTRUCTION

Although stopping further contract-letting by the government would have little physical influence there would be a decided moral effect. Besides this there would always be the possibility that the states, counties and municipalities might follow the example of the federal government. Even the possibility of such united action should tend to steady prices. Contracts let last year for public improvements other than federal amounted to 29 per cent of the total value, or ten times the federal. Figures on large projects were as follows: water-works, $36,220,000; sewers, $43,584,000; bridges, $43,477,000; streets and roads, $334,694,000.

The relative importance of private construction. and public work other than federal is shown by the chart. Here are given the monthly value of contracts reported in *Engineering News-Record*. The June, August and November figures are for five issues, instead of the usual four.

(*Continued from p. 605*)

Office building, Philadelphia, Pa., for Philadelphia Electric Co., $2,000,000.

Hotel, Asheville, N. C., for G. Vanderbilt and Battery Park Hotel Companies, $1,500,000.

School buildings, New York, N. Y., for Board of Education, 500 Park Ave., $1,915,000 and $1,400,000, respectively.

Store and office, Omaha, Neb., for C. & R. C. Cook of Chicago, $1,000,000.

Hotel, Madison, Wis., for Wisconsin Hotel Realty Co., 86 Michigan St., Milwaukee, $1,000,000.

Bridge, Blair, Neb., for Chicago and North Western R.R., $1,000,000.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 177 to 191, are the following large projects:

Railroad and telegraph system, 330 mi., between Casper and Miles City, Montana, to Peterson-Shirley and Gunther, Omaha, Neb., $12,000,000.

Office building, Los Angeles, Calif., to C. J. Kuback Co., $2,200,000.

Hotel, Chicago, Ill., to Shank and Co., $2,000,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted. Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section. The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of March 1; the next, on April 5.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.44	+$4.20	$4.50	$3.20	$3.45	$3.95	+$3.60	$4.00	$3.75
Structural rivets, 100 lb.	4.00	+4.85	5.25	3.75	4.00	5.15	4.75	4.50	5.50
Reinforcing bars, ¾ in. up, 100 lb.	3.34	+4.10	3.15	3.10	3.35	3.97½	+3.40	4.00	3.25
Steel pipe, black, 2½ to 6 in. lap, discount	51%	+52%	45%	59½%	55-5%	38%	38.2@46.5%	45%	32.76
Cast-iron pipe, 6 in. and over, ton	+62.00	+55.00	57.00	—53.20	60.50	65.00	+60.00	58.00	55.00
Concreting Material:									
Cement without bags, bbl	2.70@2.80	2.90	2.25	2.20	2.39	2.85	2.71	2.90	2.88
Gravel, ¾ in., cu.yd	2.00	1.75	2.25	2.25	1.75	1.90	2.15	+1.25	1.50
Sand, cu.yd	1.00	1.24	1.87½	2.25	1.00	1.00	1.50	+1.25	1.25
Crushed stone, ¾ in., cu.yd	1.75	2.00	2.50	2.25	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	63.00	38.00	53.00	60.50	44.75	51.00	39.00	30.00	95.00
Lime, finishing, hydrated, ton	16.80@17.10	23.00	22.50	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.95	2.50	1.50	1.25	2.70	1.75	2.80	11.00
Common brick, delivered, 1,000	23.50	13.00	11.60	11.00	17@19	12.00	—15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.0859	.115	....	.0836	.065	....	.11	.115
Hollow partition tile 4x12x12, per block	.1314	.0859	.115	.0674	....	.065	.108	.11	....
Linseed oil, raw, 5 bbl. lots, gal.	+1.08	+1.17	1.16	+1.15	+1.22	1.25	+1.15	.86	1.17
Common Labor:									
Common labor, union, hour	.60	.35	.30@.50	.....	.....	.50@.55	.56¼	....	.....
Common labor, non-union, hour	.45@.60	.30	.30@.50	.72½	.35@.50	.35@.50	.50	.30@.70	.25

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Cement and concrete laborers' rate, 81½c.; pick and shovel men, 60c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine casing. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 98.28). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $32.76; 6-in., $108.

Changes Since Last Week

Apparently reflecting an expectation of wage advances and consequent higher costs, steel mills are showing a disinclination to accept forward business.

With the pig-iron output at the heaviest point in several months, No. 2 foundry iron rose 50c.; bessemer, $1.50 and basic, $2 per gross ton at Pittsburgh, during week. Furnace coke also rose to the extent of 25c. per net ton, due to increased foreign demand.

Actual quotations on steel plates stood at $2.40@$2.65 per 100 lb., f.o.b. Pittsburgh, with $2.30, mentioned nominally. Plate mills are heavily booked and show a tendency to decline orders. Oil-tank plate inquiries show no let up and railroad car buying is heavier. Structural shapes and bars are $2.30@$2.60 per 100 lb. on current business, with $2.25 no longer quoted by the mills.

Atlanta warehouses advanced shapes, rivets and bars, 25c. per 100 lb., during week; San Francisco reports rise of 15c. on shapes and 10c. on reinforcing bars. Wrought steel pipe prices were advanced in Atlanta by a reduction of one point in the discount from list.

Consequent to the rise in coke and pig iron, cast iron pipe rose $2.50 in Atlanta; $3 in San Francisco and $4.80 per ton in New York.

Lumber prices remain very firm throughout the country, with no changes reported. Production is slightly above normal, with shipments 107 per cent and orders, 103 per cent of normal production, according to the National Lumber Trade Barometer of Mar. 23. The National Lumber Manufacturers' Association reports that orders, thus far this year, exceed production by about 640,000,000 ft., notwithstanding the great increase in output; and that shipments are less than 100,000,000 ft. under orders. This condition reflects improvement in transportation facilities and results of the campaign in the building trades to store materials in anticipation of needs as much as possible, in order to avoid transportation congestion in the peak months of Autumn.

Sand and gravel advanced 25c. per cu.yd. at bunkers in Seattle. Common brick, however, declined 50c. per. M. in San Francisco.

Linseed oil advanced 3c. in Chicago; 4c. in New York; 6c. in both Minneapolis and San Francisco and 12c. per gal. in Atlanta.

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